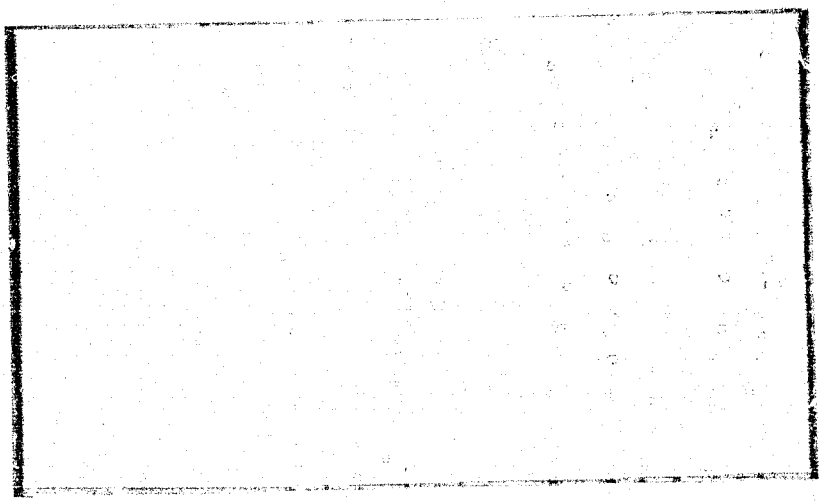
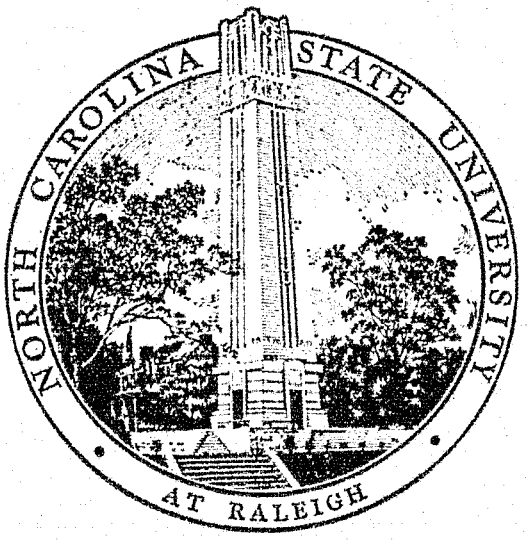
NSG-1077

(NASA-CR-158076) FLIGHT TEST EVALUATION OF PREDICTED LIGHT AIRCRAFT DRAG, PERFORMANCE, AND STABILITY (North Carolina State Univ.) 781 p HC A99/MF A01 CSCL 01C

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G3/05 43584





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A new technique was developed which permits simultaneous extraction of complete lift, drag, and thrust power curves from time histories of a single aircraft maneuver such as a pullup (from V_{max} to V_{stall}) and pushover (to V_{max} for level flight.) The technique is an extension to non-linear equations of motion of the parameter identification methods of Iliff and Taylor and includes provisions for internal data compatibility improvement as well. The technique was shown to be capable of correcting random errors in the most sensitive data channel and yielding highly accurate results. Flow charts, listings, sample inputs and outputs for the relevent routines are provided as appendices. This technique was applied to flight data taken on the ATLIT aircraft. Lack of adequate knowledge of the correct full-throttle thrust horsepower-true airspeed variation and considerable internal data inconsistency made it impossible to apply the trajectory matching features of the technique. The drag and power values obtained from the initial least squares estimate are about 15% less than the "true" values. Compared with predicted values developed using previous work at N. C. State, the extracted drag is generally higher. If one takes into account the rather "dirty" wing and fuselage existing at the time of the tests, however, the predictions are reasonably accurate. The steady state lift measurements agree well with the extracted values only for small values of α. The predicted value of the lift at $\alpha = 0$ is about 33% below that found in steady state tests while the predicted lift slope is 13% below the steady state value. Because the data processing procedure was unable to proceed beyond this initial extraction, detailed performance and stability comparisions with predictions were not attempted.

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NOMENCLATURE

a_x - linear acceleration along x-body axis.

B - coefficient used in calculating bias error in α (p. 103).

c - specific fuel consumption.

C_D - drag coefficient.

C_L - lift coefficient.

C_ℓ - general representation of a parameter (p. 111).

CLA - rate of change of lift coefficient with angle of attack.

CLAO - lift coefficient when $\alpha = 0$.

CLAX - rate of change of lift coefficient with respect to α^x.

CLQ - rate of change in lift coefficient with pitching velocity.

D - drag.

D - weights on elements of cost function.

d - dimensionless numbers used to scale weights in cost function.

E_{m_i} - energy, measured at specific point.

f(t) - function of time.

$f(\alpha)$ - functional representation for use in Newton-Raphson process (p. 106).

g - acceleration due to gravity.

h - altitude.

$\dot{h}$ - rate of climb.

$\ddot{h}$ - altitude acceleration.

H(n) - filter response.

J - cost function.

L - lift.

M - slope.

$\dot{m}$ - mass flow rate.

n - number of harmonics.

P - power (p. 36).

P - altitude pressure (p. 66).

P_S - stagnation pressure.

$\dot{P}$ - time rate of change of pressure.

q - pitching velocity.

$\dot{q}$ - pitching acceleration.

q_c - differential pressure between pitot and static pressures.

R - gas constant for air.

r - radial displacement or yaw rate.

S - area (p. 19).

S - fit error (p. 38).

S_T - tail area.

S_W - wing area.

T - thrust (p. 36).

T - total time (p. 53).

T - local free stream absolute temperature (p. 68).

t - time.

T_S - stagnation temperature.

u - component of aircraft velocity on x-body axis (p. 65).

u - fluid velocity (p. 70).

$\dot{u}$ - acceleration along the x-body axis.

V - velocity of aircraft along flight path.

$\dot{V}$ - acceleration of aircraft along flight path.

$\ddot{V}$ - rate of change of vehicle acceleration along flight path.

W - weight.

w - component of aircraft velocity along z-body axis.

WGTL - lower constraint weight.

WGTU - upper constraint weight.

x - horizontal displacement.

X - exponent in lift expression (p. 105).

X_{ax} - displacement of accelerometer from c.g.

α - angle of attack.

$\dot{\alpha}$ - time rate of change of angle of attack.

γ - flight path angle (p. 36).

γ - ratio of specific heats (p. 68).

$\dot{\gamma}$ - flight path angular velocity.

$\ddot{\gamma}$ - flight path angular acceleration.

$\dddot{\gamma}$ - rate of change of flight path angular acceleration.

δ^* - displacement thickness.

θ - pitch angle.

$\dot{\theta}$ - pitching velocity

λ - time interval.

μ - coefficient of viscosity.

ρ - density.

τ - time constant.

ϕ - bank angle.

ω - frequency.

SUBSCRIPTS

c	-	cutoff value.
DATA	-	refers to measured value.
DRAG	-	refers to values obtained from drag equation.
fus	-	fuselage.
LIFT	-	refers to values obtained from lift equation.
N	-	last point in data set.
t	-	tail.
t_v	-	vertical tail.

SUPERSCRIPTS

' - measured value.

" - lag-free value.

^ - estimated value of the variable.

INTRODUCTION

The value of any predictive procedure depends rather fundamentally upon its success in forecasting the behavior of the item with which it's associated under actual use conditions. Thus, a technique for predicting the lift, drag, and pitching moment of a proposed aircraft is useful to the extent that it foretells the forces and moments which will be experienced by the flight hardware. It is usually in the nature of things that the better the job the technique does, the more difficult and expensive it is to use. Fortunately, the introduction of increasingly sophisticated digital computers has made it possible to increase the rigor of lift, drag, and moment predictive techniques without significant increases in the cost of employing them. This process can be expected to continue as computer capabilities improve.

Even a supposedly rigorous technique, however, may not be useful if it does not do a good job of predicting what actually occurs. The analytical model, for example, may be too crude or important effects may not have been treated at all. It is therefore important that new predictive techniques be evaluated critically under actual use conditions before they are employed extensively for preliminary design activity.

It was intended that this procedure be followed in the case of the predictive techniques developed in Reference 1. The vehicle to which they were applied was a modified Piper Seneca (ATLIT). The predictions of lift, drag, and pitching moment to be encountered during cruise flight were developed using the computer program described in Reference 1 and the vehicle's geometry as obtained from Piper shop drawings. Performance predictions and stability predictions were also made using in these instances the programs described in References 2 and 3. The aircraft itself was then flight tested to determine the parameter values actually experienced. This report outlines the methods by which the parameter predictions were obtained, presents their results, describes the methods by which the parameter values were obtained from flight data, and gives these results.

LIFT AND DRAG PREDICTION

Wing

The ATLIT airplane employs a straight, tapered wing with a GA(W)-1 airfoil section 17% thick. The computational technique distributes 65 regions of constant vorticity on the surface of the airfoil, calculates from this an inviscid flow field and pressure distribution, then determines the boundary layer growth corresponding to this pressure distribution, and recomputes the inviscid flow field of a pseudo airfoil whose ordinates are now the physical airfoil ordinates plus the local values of δ^* with a modification so as to locate the trailing edge stagnation point downstream in the wake. This process goes through four iterations so that the computed pressure distribution obtained after the last potential (inviscid) solution is essentially the same as that used to generate the boundary layer solution which formed the basis for that potential solution. The program gives section lift, drag, and moment. The drag includes both skin friction drag and form drag. However, because of the flow model used, extensive regions of flow separation cannot be treated. For this reason, the data are unreliable above $C_L = 0.8$.

The outputs (lift, drag, and moment vs. α for a given Reynolds number) from the airfoil program are fed into a curve fitting routine which provides polynomial representations of the results for use by the wing program. This program uses lifting line theory to modify the local angle of attack which the airfoil data "sees" according to spanwise changes in twist, camber, thickness, and chord length. Spanwise variations in Reynolds number are handled by providing as input tip and root data at the correct Reynolds number with the program interpolating to obtain the data for other spanwise stations. Inviscid wing-fuselage interference is treated by transforming the fuselage mathematically into a vertical slit and distributing its effects along the span. The output of the program is the three-dimensional lift, drag, and pitching moment of the wing. Note that the drag includes both profile and induced drags.

The same procedure is employed to find the contributions of the tail surfaces to the overall aircraft lift, drag, and moment. The vertical tail was considered to be half of a symmetric surface unaffected by the presence of the horizontal tail. The horizontal tail was assumed to be unaffected by the presence of the vertical tail, propeller slip-stream, or the downwash of the wing.

The input data and results of the various computations are shown in figures 1 through 7.

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***** CASE INPUT *****

WHITCOMB/A=-4.,-2.,0.,2.,4.,6.,8.,10.,12.,14/RN=5.7,FREE TRANSITION/M=.15

NXU	NXL	IWRITE	IALPHA	IPUNCH
38	38	3	0	1

XU = 0.0 0.200000E-02 0.500000E-02 0.125000E-01 0.250000E-01 0.375000E-01 0.500000E-01 0.750000E-01
0.100000E 00 0.125000E 00 0.150000E 00 0.175000E 00 0.200000E 00 0.250000E 00 0.300000E 00 0.350000E 00
0.400000E 00 0.450000E 00 0.500000E 00 0.550000E 00 0.575000E 00 0.600000E 00 0.625000E 00 0.650000E 00
0.675000E 00 0.700000E 00 0.725000E 00 0.750000E 00 0.775000E 00 0.800000E 00 0.825000E 00 0.850000E 00
0.875000E 00 0.900000E 00 0.925000E 00 0.950000E 00 0.975000E 00 0.100000E 01

ZU = 0.0 0.130000E-01 0.204000E-01 0.307000E-01 0.417000E-01 0.496500E-01 0.558900E-01 0.655100E-01
0.730000E-01 0.790000E-01 0.840000E-01 0.883999E-01 0.919999E-01 0.977000E-01 0.101600E 00 0.104000E 00
0.104910E 00 0.104450E 00 0.102580E 00 0.991000E-01 0.966800E-01 0.937099E-01 0.900600E-01 0.859900E-01
0.813600E-01 0.763400E-01 0.709200E-01 0.651300E-01 0.590700E-01 0.528600E-01 0.464600E-01 0.398800E-01
0.331500E-01 0.263900E-01 0.196100E-01 0.128700E-01 0.609000E-02-0.700000E-03

XL = 0.0 0.200000E-02 0.500000E-02 0.125000E-01 0.250000E-01 0.375000E-01 0.500000E-01 0.750000E-01
0.100000E 00 0.125000E 00 0.150000E 00 0.175000E 00 0.200000E 00 0.250000E 00 0.300000E 00 0.350000E 00
0.400000E 00 0.450000E 00 0.500000E 00 0.550000E 00 0.575000E 00 0.600000E 00 0.625000E 00 0.650000E 00
0.675000E 00 0.700000E 00 0.725000E 00 0.750000E 00 0.775000E 00 0.800000E 00 0.825000E 00 0.850000E 00
0.875000E 00 0.900000E 00 0.925000E 00 0.950000E 00 0.975000E 00 0.100000E 01

ZL = 0.0 -0.930000E-02-0.138000E-01-0.205000E-01-0.269000E-01-0.319000E-01-0.358000E-01-0.421000E-01
-0.470000E-01-0.510000E-01-0.543000E-01-0.570000E-01-0.593000E-01-0.627000E-01-0.645000E-01-0.652000E-01
-0.649000E-01-0.635000E-01-0.610000E-01-0.570000E-01-0.540000E-01-0.508000E-01-0.469000E-01-0.428000E-01
-0.384000E-01-0.340000E-01-0.294000E-01-0.249000E-01-0.204000E-01-0.160000E-01-0.120000E-01-0.860000E-02
-0.580000E-02-0.360000E-02-0.250000E-02-0.260000E-02-0.400000E-02-0.800000E-02

NA = 10 ANGLES OF ATTACK W.R.T. REFERENCE LINE (IALPHA=0) OR W.R.T. LONGEST CHORDLINE (IALPHA=1)

-0.400000E 01 -0.200000E 01 0.0 0.200000E 01 0.400000E 01 0.600000E 01
0.800000E 01 0.100000E 02 0.120000E 02 0.140000E 02

NM = 1 FSMACH = 0.150000E 00

CREF = 0.100000E 01 SF = 0.100000E 01 TO = 0.518690E 03 RN = 0.570000E 01 PR = 0.770000E 00 KF = 0.100000E 01

	LTRAN	XTRAN	ZTRAN
UPPER SURFACE	0	0.0	0.0
LOWER SURFACE	0	0.0	0.0

WHITCOMB/A=-4.,-2.,0.,2.,4.,6.,8.,10.,12.,14/RN=5.7,FREE TRANSITION/M=.15
FSMACH = 0.15000

ALPHA	CL	CD	CM(NOSE)	CM(1/4-CHORD)
-4.000000	-0.023224	0.006249	-0.086099	-0.092000
-2.000000	0.213498	0.005605	-0.150842	-0.097549
0.0	0.438188	0.006357	-0.212167	-0.102620
2.000000	0.666128	0.007707	-0.274192	-0.107695
4.000000	0.894763	0.009055	-0.335486	-0.112182
6.000000	1.120211	0.010642	-0.395287	-0.116490
8.000000	1.338393	0.012475	-0.451681	-0.119905
10.000000	1.548673	0.015151	-0.504635	-0.122691
12.000000	1.748252	0.017997	-0.552386	-0.123939
14.000000	1.928573	0.021817	-0.591455	-0.122314

FIGURE 1

```
*****  CASE INPUT  *****

0009/A=-6.-4.-2.0.2.4.6.8.10.12/FREE TRANSITION/M=.15/RN=3.0/SF=CREF=1.0

 NXU   NXL  IWRITE  IALPHA  IPUNCH
 19    19     3       0       1

          XU =  0.0          0.500000E-02 0.125000E-01 0.250000E-01 0.500000E-01 0.750000E-01 0.100000E 00 0.150000E 00
                0.200000E 00 0.250000E 00 0.300000E 00 0.400000E 00 0.500000E 00 0.600000E 00 0.700000E 00 0.800000E 00
                0.900000E 00 0.950000E 00 0.100000E 01
          ZU =  0.0          0.100000E-01 0.142000E-01 0.196100E-01 0.266600E-01 0.315000E-01 0.351200E-01 0.400900E-01
                0.430300E-01 0.445600E-01 0.450100E-01 0.435200E-01 0.397100E-01 0.342300E-01 0.274800E-01 0.196700E-01
                0.108600E-01 0.605000E-02 0.950000E-03
          XL =  0.0          0.500000E-02 0.125000E-01 0.250000E-01 0.500000E-01 0.750000E-01 0.100000E 00 0.150000E 00
                0.200000E 00 0.250000E 00 0.300000E 00 0.400000E 00 0.500000E 00 0.600000E 00 0.700000E 00 0.800000E 00
                0.900000E 00 0.950000E 00 0.100000E 01
          ZL =  0.0         -0.100000E-01-0.142000E-01-0.196100E-01-0.266600E-01-0.315000E-01-0.351200E-01-0.400900E-01
                -0.430300E-01-0.445600E-01-0.450100E-01-0.435200E-01-0.397100E-01-0.342300E-01-0.274800E-01-0.196700E-01
                -0.108600E-01-0.605000E-02-0.950000E-03

 NA = 10     ANGLES OF ATTACK W.R.T. REFERENCE LINE (IALPHA=0) OR W.R.T. LONGEST CHORDLINE (IALPHA=1)

              -0.600000E 01  -0.400000E 01  -0.200000E 01   0.0            0.200000E 01   0.400000E 01
               0.600000E 01   0.800000E 01   0.100000E 02   0.120000E 02

 NM =  1                FSMACH            = 0.150000E 00

CREF =  0.100000E 01  SF =  0.100000E 01  T0 =  0.518690E 03  RN =  0.300000E 01  PR =  0.720000E 00  KF =  0.100000E 01

                    LTRAN     XTRAN          ZTRAN

UPPER SURFACE         0        0.0            0.0
LOWER SURFACE         0        0.0            0.0

0009/A=-6.-4.-2.0.2.4.6.8.10.12/FREE TRANSITION/M=.15/RN=3.0/SF=CREF=1.0
                    FSMACH =  0.15000

*************************************************************************
*    ALPHA          CL          CD          CM(NOSE)     CM(1/4-CHORD)  *
*                                                                       *
*  -6.000000      -0.639027    0.007929     0.161376      0.002287      *
*  -4.000000      -0.430504    0.007073     0.110331      0.002844      *
*  -2.000000      -0.216409    0.006283     0.055765      0.001641      *
*   0.0            0.000019    0.005804    -0.000008     -0.000004      *
*   2.000000      0.216441     0.006282    -0.055780     -0.001647      *
*   4.000000      0.430541     0.007070    -0.110348     -0.002852      *
*   6.000000      0.639190     0.007936    -0.161459     -0.002330      *
*   8.000000      0.853717     0.009510    -0.215147     -0.003464      *
*  10.000000      1.060093     0.011856    -0.265412     -0.003900      *
*  12.000000      1.251046     0.015075    -0.309520     -0.002810      *
*************************************************************************
```

FIGURE 2

ORIGINAL PAGE IS
OF POOR QUALITY

TWO DIMENSIONAL AIRFOIL DATA INPUT

WHITCOMB/A=-4.-2.0.2.4.6.8.10.12.14/RN=5.7.FREE TRANSITION/M=.15

THE NUMBER OF DATA POINTS IS = 10

ALPHA	CL	CD	CM
-4.000000	-0.023224	0.006249	-0.092000
-2.000000	0.213500	0.005605	-0.097549
0.0	0.438190	0.006357	-0.102620
2.000000	0.666130	0.007707	-0.107690
4.000000	0.894760	0.009055	-0.112180
6.000000	1.120199	0.010642	-0.116490
8.000000	1.338400	0.012475	-0.119910
10.000000	1.548699	0.015151	-0.122690
12.000000	1.748300	0.017997	-0.123940
14.000000	1.928499	0.021817	-0.122310

TWO DIMENSIONAL CURVE FIT FUNCTION DATA
OF THE FORM Y=C(0)+C(1)*X+C(2)*X**2+...

WHITCOMB/A=-4.-2.0.2.4.6.8.10.12.14/RN=5.7.FREE TRANSITION/M=.15

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	0.43993	0.11427	-0.00019	0.00002	-0.00000	DOMAIN=	-4.0000	TO	14.0000
CD VERSUS CL	0.00608	-0.00466	0.01623	-0.01096	0.00311	DOMAIN=	-0.0232	TO	1.9285
CM VERSUS CL	-0.09253	-0.02625	0.01076	-0.00997	0.00377	DOMAIN=	-0.0232	TO	1.9285
ALPHA VERSUS CL	-3.81031	8.41611	0.87390	-0.86891	0.32962	DOMAIN=	-0.0232	TO	1.9285

FIGURE 3

TWO DIMENSIONAL AIRFOIL DATA INPUT

0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/FREE TRANSITION/M=.15/RN=3.0/SF=CREF=1.0

THE NUMBER OF DATA POINTS IS = 10

ALPHA	CL	CD	CM
-6.000000	-0.639030	0.007929	0.002287
-4.000000	-0.430500	0.007073	0.002844
-2.000000	-0.216410	0.006283	0.001641
0.0	0.000019	0.005804	-0.000004
2.000000	0.216440	0.006282	-0.001647
4.000000	0.430540	0.007070	-0.002852
6.000000	0.639190	0.007936	-0.002330
8.000000	0.853720	0.009509	-0.003464
10.000000	1.060100	0.011856	-0.003900
12.000000	1.250999	0.015075	-0.002810

TWO DIMENSIONAL CURVE FIT FUNCTION DATA
OF THE FORM Y=C(0)+C(1)*X+C(2)*X**2+...

0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/FREE TRANSITION/M=.15/RN=3.0/SF=CREF=1.0

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	-0.00109	0.10769	0.00012	-0.00002	-0.00000	DOMAIN=	-6.0000	TO	12.0000
CD VERSUS CL	0.00608	0.00006	0.00407	-0.00036	0.00131	DOMAIN=	-0.6390	TO	1.2510
CM VERSUS CL	0.00011	-0.00721	0.00001	0.00685	-0.00310	DOMAIN=	-0.6390	TO	1.2510
ALPHA VERSUS CL	0.01138	9.28779	-0.11110	0.14828	0.09731	DOMAIN=	-0.6390	TO	1.2510

FIGURE 4

ORIGINAL PAGE IS
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TWO DIMENSIONAL CURVE FIT FUNCTION DATA
OF THE FORM Y=C(0)+C(1)*X+C(2)*X**2+...

WHITCOMB/A=-4.,-2.0,2.4,6.8,10.12,14/RN=5.7,FREE TRANSITION/M=.15
THICKNESS RATIO= 0.17

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	0.43993	0.11427	-0.00019	0.00002	-0.00000	DOMAIN=	-4.0000	TO	14.0000
CD VERSUS CL	0.00608	-0.00466	0.01623	-0.01096	0.00311	DOMAIN=	-0.0232	TO	1.9285
CM VERSUS CL	-0.09253	-0.02625	0.01076	-0.00997	0.00377	DOMAIN=	-0.0232	TO	1.9285
ALPHA VERSUS CL	-3.81030	8.41610	0.87385	-0.86887	0.32961	DOMAIN=	-0.0232	TO	1.9285

WHITCOMB/A=-4.,-2.0,2.4,6.8,10.12,14/RN=5.7,FREE TRANSITION/M=.15
THICKNESS RATIO= 0.17

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	0.43993	0.11427	-0.00019	0.00002	-0.00000	DOMAIN=	-4.0000	TO	14.0000
CD VERSUS CL	0.00608	-0.00466	0.01623	-0.01096	0.00311	DOMAIN=	-0.0232	TO	1.9285
CM VERSUS CL	-0.09253	-0.02625	0.01076	-0.00997	0.00377	DOMAIN=	-0.0232	TO	1.9285
ALPHA VERSUS CL	-3.81030	8.41610	0.87385	-0.86887	0.32961	DOMAIN=	-0.0232	TO	1.9285

M=.15 WHITCOMB AIRFOIL/RN=5.7 MILLION/17 PERCENT THICK NEW NASA WING

BODY HEIGHT / SPAN . . . . . =	0.11	BODY WIDTH / SPAN. . . . . =	0.10
ASPECT RATIO . . . . . =	10.18	WING HEIGHT / SPAN . . . . . =	-0.04
WING BODY INCIDENCE, DEG . . =	0.0	TIP THICKNESS CHORD. . . . . =	0.17
ROOT THICKNESS CHORD . . . . =	0.17	GEOMETRIC TWIST, DEG . . . . =	-3.00
NUMBER OF SPANWISE STATIONS. =	20.00	AERODYNAMIC TWIST, DEG . . . =	-3.00
TAPER RATIO. . . . . =	0.50	REYNOLDS NUMBER. . . . . =	5.70
COORDINATES OF MOMENT REFERENCE POINT		X= 0.0 Z= 0.0	
VALUE OF DISCRIMINANT. . . . =	0.001000		

THREE DIMENSIONAL LIFT, DRAG, AND MOMENT DATA

ALPHA	CL	CDP	CDI	CD	CM
-4.000000	-0.134572	0.006471	0.000845	0.007316	-0.088299
-2.000000	0.063437	0.005717	0.000328	0.006045	-0.093561
0.0	0.259755	0.005686	0.002663	0.008349	-0.098313
2.000000	0.454469	0.006348	0.007784	0.014132	-0.102669
4.000000	0.648288	0.007393	0.015658	0.023051	-0.106861
6.000000	0.841228	0.008643	0.026248	0.034890	-0.110939
8.000000	1.032696	0.010037	0.039469	0.049506	-0.114788
10.000000	1.221716	0.011624	0.055164	0.066788	-0.118148
12.000000	1.405899	0.013535	0.072973	0.086508	-0.120638
14.000000	1.582717	0.015940	0.092385	0.108325	-0.121863

FIGURE 5

TWO DIMENSIONAL CURVE FIT FUNCTION DATA
OF THE FORM Y=C(0)+C(1)*X+C(2)*X**2+...

ATLIT HORIZONTAL TAIL SECTION--0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/RN=3./M=.15
THICKNESS RATIO= 0.09

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	-0.00109	0.10769	0.00012	-0.00002	-0.00000	DOMAIN=	-6.0000	TO	12.0000
CD VERSUS CL	0.00608	0.00006	0.00407	-0.00036	0.00131	DOMAIN=	-0.6390	TO	1.2510
CM VERSUS CL	0.00011	-0.00721	0.00001	0.00685	-0.00310	DOMAIN=	-0.6390	TO	1.2510
ALPHA VERSUS CL	0.01138	9.28780	-0.11110	0.14829	0.09729	DOMAIN=	-0.6390	TO	1.2510

ATLIT HORIZONTAL TAIL SECTION--0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/RN=3./M=.15
THICKNESS RATIO= 0.09

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	-0.00109	0.10769	0.00012	-0.00002	-0.00000	DOMAIN=	-6.0000	TO	12.0000
CD VERSUS CL	0.00608	0.00006	0.00407	-0.00036	0.00131	DOMAIN=	-0.6390	TO	1.2510
CM VERSUS CL	0.00011	-0.00721	0.00001	0.00685	-0.00310	DOMAIN=	-0.6390	TO	1.2510
ALPHA VERSUS CL	0.01138	9.28780	-0.11110	0.14829	0.09729	DOMAIN=	-0.6390	TO	1.2510

ATLIT HORIZONTAL TAIL USING NACA 0009 AIRFOIL/RN=3.0 MILLION MACH#=.15

BODY HEIGHT / SPAN . . . . . =	0.16	BODY WIDTH / SPAN. . . . . =	0.15
ASPECT RATIO . . . . . =	4.75	WING HEIGHT / SPAN . . . . . =	0.0
WING BODY INCIDENCE, DEG . . =	0.0	TIP THICKNESS CHORD. . . . . =	0.09
ROOT THICKNESS CHORD . . . . =	0.09	GEOMETRIC TWIST, DEG . . . . =	0.0
NUMBER OF SPANWISE STATIONS. =	20.00	AERODYNAMIC TWIST, DEG . . . =	0.0
TAPER RATIO. . . . . =	1.00	REYNOLDS NUMBER. . . . . =	3.00
COORDINATES OF MOMENT REFERENCE POINT		X= 0.0 Z= 0.0	
VALUE OF DISCRIMINANT. . . . =	0.001000		

THREE DIMENSIONAL LIFT, DRAG, AND MOMENT DATA

ALPHA	CL	CDP	CDI	CD	CM
-6.000000	-0.449000	0.006908	0.017090	0.023998	0.002427
-4.000000	-0.300239	0.006339	0.007641	0.013980	0.002019
-2.000000	-0.150733	0.006026	0.001925	0.007951	0.001169
0.0	-0.000492	0.005933	-0.000000	0.005933	0.000115
2.000000	0.149765	0.006041	0.001901	0.007942	-0.000943
4.000000	0.300187	0.006352	0.007636	0.013988	-0.001863
6.000000	0.450217	0.006890	0.017182	0.024072	-0.002552
8.000000	0.599307	0.007694	0.030441	0.038136	-0.002976
10.000000	0.746855	0.008821	0.047263	0.056084	-0.003152
12.000000	0.892116	0.010332	0.067407	0.077739	-0.003152

FIGURE 6

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TWO DIMENSIONAL CURVE FIT FUNCTION DATA
OF THE FORM Y=C(0)+C(1)*X+C(2)*X**2+...

ATLIT VERTICAL TAIL SECTION--0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/RN=3./M=.15
THICKNESS RATIO= 0.09

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	-0.00109	0.10769	0.00012	-0.00002	-0.00000	DOMAIN=	-6.0000	TO	12.0000
CD VERSUS CL	0.00608	0.00006	0.00407	-0.00036	0.00131	DOMAIN=	-0.6390	TO	1.2510
CM VERSUS CL	0.00011	-0.00721	0.00001	0.00685	-0.00310	DOMAIN=	-0.6390	TO	1.2510
ALPHA VERSUS CL	0.01138	9.28780	-0.11110	0.14829	0.09729	DOMAIN=	-0.6390	TO	1.2510

ATLIT VERTICAL TAIL SECTION--0009/A=-6.,-4.,-2.,0.,2.,4.,6.,8.,10.,12/RN=3./M=.15
THICKNESS RATIO= 0.09

	C(0)	C(1)	C(2)	C(3)	C(4)				
CL VERSUS ALPHA	-0.00109	0.10769	0.00012	-0.00002	-0.00000	DOMAIN=	-6.0000	TO	12.0000
CD VERSUS CL	0.00608	0.00006	0.00407	-0.00036	0.00131	DOMAIN=	-0.6390	TO	1.2510
CM VERSUS CL	0.00011	-0.00721	0.00001	0.00685	-0.00310	DOMAIN=	-0.6390	TO	1.2510
ALPHA VERSUS CL	0.01138	9.28780	-0.11110	0.14829	0.09729	DOMAIN=	-0.6390	TO	1.2510

ATLIT VERTICAL TAIL USING NACA 0009 AIRFOIL/RN=3.0 MILLION/MACH#=.15

BODY HEIGHT / SPAN . . . . . =	0.05	BODY WIDTH / SPAN. . . . . =	0.05
ASPECT RATIO . . . . . =	3.60	WING HEIGHT / SPAN . . . . . =	0.0
WING BODY INCIDENCE. DEG . . =	0.0	TIP THICKNESS CHORD. . . . . =	0.09
ROOT THICKNESS CHORD . . . . =	0.09	GEOMETRIC TWIST. DEG . . . . =	0.0
NUMBER OF SPANWISE STATIONS. =	20.00	AERODYNAMIC TWIST. DEG . . . =	0.0
TAPER RATIO. . . . . =	0.40	REYNOLDS NUMBER. . . . . =	3.00
COORDINATES OF MOMENT REFERENCE POINT		X= 0.0 Z= 0.0	
VALUE OF DISCRIMINANT. . . . =	0.001000		

THREE DIMENSIONAL LIFT, DRAG, AND MOMENT DATA

ALPHA	CL	CDP	CDI	CD	CM
-6.000000	-0.378216	0.006636	0.012877	0.019513	0.002436
-4.000000	-0.252761	0.006277	0.005751	0.012028	0.001845
-2.000000	-0.126856	0.006075	0.001449	0.007524	0.001033
0.0	-0.000549	0.006015	0.000000	0.006015	0.000119
2.000000	0.125829	0.006088	0.001425	0.007514	-0.000797
4.000000	0.252360	0.006295	0.005733	0.012028	-0.001638
6.000000	0.378752	0.006643	0.012913	0.019556	-0.002344
8.000000	0.504801	0.007149	0.022939	0.030087	-0.002878
10.000000	0.630221	0.007833	0.035755	0.043587	-0.003226
12.000000	0.754719	0.008724	0.051280	0.060004	-0.003395

FIGURE 7

Fuselage and Nacelles

The program to compute the forces and moments on isolated, quasi-streamlined bodies having a plane of symmetry represents the half-surface by 560 flat panels of more or less equal area. On each panel is distributed a uniform source whose strength is such that the flow due to all sources is everywhere parallel to the surface. Then, a streamline which goes through the centroid of a particular panel is traced upstream to its inception point. Along this streamline is calculated the boundary layer displacement thickness and skin friction by a momentum integral method. This is done for all 560 panels. At the downstream end of the body the wake is arbitrarily assumed to begin at the upstream end of the last two sets of panels. The angle of the wake leaving the body is determined by the history of the boundary layer displacement up to that point. This wake is then paneled to a stagnation point downstream in the physical wake and the inviscid pressure distribution on the body plus wake body recomputed. The calculated skin friction is integrated over the body to find the skin friction drag and the recomputed pressure distribution is integrated in the normal and axial directions to find the lift and form drag. The same data are also used in computing the pitching moment.

Because the boundary layer routine used is two-dimensional it is not valid when the flow is expanding or contracting rapidly, i.e., near the nose or tail of a body, or when there is a significant cross flow, i.e., at angle of attack. For this reason the aircraft drag computation is reasonable only in the cruise configuration. In the context of an overall drag computation this is not unduly limiting because the wing drag calculation fails for high angles of attack as well. Several attempts were made to extend the angle of attack range of the computation at least for axisymmetric bodies, by using an axisymmetric finite difference boundary layer routine in the plane of symmetry in order to locate the lee-side separation point and then applying the Allen-Perkins (Ref. 4) technique to determine the normal force. However, the computed separation point was not regularly located sufficiently close to physical separation point (as found experimentally) to make this approach viable.

Modeling fuselages and nacelles for the purposes of drag computation as isolated bodies of course ignores interference effects. While it is conceivable that the inviscid aspects of interference could be treated adequately (and in fact have been in many cases), it will require a general three-dimensional boundary layer solution to treat the viscous aspects adequately. Since such solution techniques will be some time in coming, it continues to be necessary to treat these effects empirically. Because other approximations in the model can be expected to yield uncertainties of the same order of magnitude, no attempt was made to account for these effects.

Figures 8 through 11 show the input data and calculated results for the ATLIT fuselage and nacelles.

```
ATLIT WITH M=21 AND N=29 YIELDING 560 PANELS -- FUSELAGE ONLY
          1                              1 21 29
0.       7.5     16.5    25.5    35.0    45.0    55.0    65.0    75.0    86.5      XFUS10
97.5    108.     118.5   129.5   140.5   151.0   162.0   172.5   184.0   195.5     XFUS20
207.5   220.5    232.0   244.5   256.5   273.0   293.0   312.6   339.0             XFUS29
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000            Y1
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000            Y1
 0.0000                                                                           Y1
43.250043.250043.250043.250043.250043.250043.250043.250043.250043.2500           Z1
43.250043.250043.250043.250043.250043.250043.250043.250043.250043.2500           Z1
43.2500                                                                          Z1
 0.0000 0.9000 1.8000 2.7750 3.7375 4.7375 5.7875 6.7500 7.5750 8.1250            Y2
 8.3250 8.1750 7.6625 6.8750 5.8500 4.8375 3.8000 2.7750 1.8000 0.9000            Y2
 0.0000                                                                          Y2
38.012538.025038.112538.275038.512538.875039.425040.162541.150042.3125          Z2
43.600044.862546.100047.100047.900048.462548.850049.125049.275049.3500          Z2
49.4000                                                                          Z2
 0.0000 1.3875 2.6375 4.1625 5.8813 7.6500 9.525011.225012.125012.5625           Y3
12.700012.525011.875010.6875 9.1500 7.4875 5.7875 4.2250 2.7750 1.3875           Y3
 0.0000                                                                          Y3
35.700035.718735.762535.875036.087536.475037.262538.712540.475042.4375          Z3
44.412546.400048.287549.900051.100051.913052.450052.775052.950053.0500          Z3
53.0750                                                                          Z3
 0.0000 1.6750 3.4375 5.4500 7.675010.187512.775014.213015.125015.4875           Y4
15.588015.500014.825013.475011.5130 9.3875 7.2500 5.2250 3.3750 1.6500           Y4
 0.0000                                                                          Y4
34.462534.462534.462534.462534.512534.900036.150037.887540.500042.9125          Z4
45.037547.487549.875051.925053.475054.425055.000055.338055.538055.6250          Z4
55.6630                                                                          Z4
 0.0000 1.5250 3.4750 5.1750 8.513011.363014.375016.450017.275017.6000           Y5
17.675017.650017.088015.675013.500010.8380 8.2500 5.9250 3.8130 1.8250           Y5
 0.0000                                                                          Y5
33.425033.425033.425033.425033.425033.575034.575037.087539.900042.7250          Z5
44.875048.250051.000053.462555.225056.313056.900057.225057.388057.4750          Z5
57.5000                                                                          Z5
 0.0000 2.1000 4.2375 6.6375 9.362512.750016.275018.225019.063019.3750           Y6
19.488019.500019.175018.025015.688012.6750 9.7000 6.7000 4.7880 2.1375           Y6
 0.0000                                                                          Y6
32.262532.262532.262532.262532.262532.312533.250035.675038.837541.9625          Z6
45.025048.062551.262554.100056.350057.625058.263058.625058.763058.8250          Z6
58.8750                                                                          Z6
 0.0000 2.2500 4.6090 7.109010.690014.656018.594020.440021.030021.2500           Y7
21.340021.330021.047019.780017.190013.690010.3750  .3100 4.7000 2.3100           Y7
 0.0000                                                                          Y7
31.187 31.187 31.187 31.187 31.187 31.187 31.22  35.281 39.375 42.344            Z7
45.797 49.156 52.563 55.875 58.188 59.422 60.0   60.25  60.42  60.44             Z7
60.44                                                                            Z7
 0.0000 2.5780 5.2500 8.187511.656016.063020.406022.270022.688022.8600           Y8
22.906022.950022.730021.610018.780014.970011.2500 8.0000 5.1250 2.5000           Y8
 0.0000                                                                          Y8
30.585030.585030.585030.585030.585030.585031.395035.022038.460042.6320          Z8
46.319049.945053.585057.365059.898061.257061.773061.960062.085062.1160          Z8
62.1160                                                                          Z8
 0.0000 2.5750 5.2500 8.200011.675016.075020.950022.825023.225023.5750           Y9
23.850023.975023.875022.875019.950016.000012.0500 8.6375 5.4500 2.6750           Y9
 0.0000                                                                          Y9
29.25  29.25  29.25  29.25  29.25  29.25  30.225 34.05  38.275042.0750            Z9
45.925049.775053.650057.688060.538061.925062.463062.650062.800062.8130          Z9
62.8380                                                                          Z9
 0.0000 3.0000 6.750010.750014.500019.250021.250022.500023.500024.0000           Y10
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FIGURE 8

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24.500024.750024.750023.500020.500016.500012.7500 9.0000 5.7500 2.8750  Y10
 0.0000
27.750027.750027.750027.750027.750027.750030.000034.000037.875041.7500  Y10
45.500049.500053.625057.500060.500062.250063.000063.250063.250063.2500  Z10
63.2500
 0.0000 3.5000 7.750011.875016.125019.875022.750024.750025.500025.8750  Z10
26.000025.500024.875023.625021.750018.750015.000011.0000 7.0000 3.5000  Z10
 0.0000
27.000027.000027.000027.000027.000027.000030.750036.000040.375044.6250  Y11
48.750052.875056.500060.875064.500067.500069.500070.375070.500070.5000  Y11
70.5000
 0.0000 3.7500 7.500011.500015.250020.250024.250025.375025.875026.2500  Z11
26.500026.000025.500025.000024.000021.625017.750013.0000 8.3750 4.1250  Z11
 0.0000
26.585026.585026.585026.585026.585026.585031.585037.835042.335046.7100  Y12
50.835055.085059.335063.460067.835071.835074.085074.960075.085075.0850  Y12
75.0850
 0.0000 4.125010.000015.000020.500023.250025.125025.750026.125026.2500  Z12
26.250026.000025.500025.000024.000021.625017.750012.8750 8.3750 4.1250  Z12
 0.0000
25.650025.650025.650025.650025.650028.025033.025038.150042.900047.1500  Y13
51.400055.650059.900064.150068.900073.275075.900076.900077.150077.1500  Y13
77.1500
 0.0000 5.125010.250015.000021.625024.000025.500026.000026.200026.3000  Z13
26.500026.300026.250026.250025.500022.875018.750013.5000 8.6250 4.2500  Z13
 0.0000
25.250025.250025.250025.250025.250027.750033.000038.250043.000047.3750  Y14
51.750056.000060.375064.750070.125074.500077.250078.125078.250078.2500  Y14
78.2500
 0.0000 5.000010.000014.750022.500023.750025.000025.750026.250026.5000  Z14
26.500026.500026.250026.000025.125022.500018.375013.3750 8.5000 4.2500  Z14
 0.0000
24.750024.750024.750024.750024.750027.370032.620037.620042.250046.6250  Y15
51.000055.250059.500064.250069.125073.500076.000077.000077.250077.2500  Y15
77.2500
 0.0000 4.1250 9.875014.875020.750023.250025.000025.625026.125026.3750  Z15
26.500026.250026.000025.250024.125021.500017.500013.0000 8.2500 4.0000  Z15
 0.0000
24.330024.330024.330024.330024.330026.580031.580036.705041.330045.5800  Y16
49.830053.955058.330062.830067.580071.705 74.58  75.58  75.83  75.83     Y16
75.83
 0.0000 4.7500 9.750014.500020.750022.875024.750025.625026.250026.3750  Z16
26.500026.250025.875025.250024.000021.500017.500012.8750 8.3750 4.0000  Z16
 0.0000
23.750023.750023.750023.750023.750026.370031.250036.000040.500044.8750  Y17
49.250053.500057.625062.125066.500070.625073.250074.375074.750074.7500  Y17
74.7500
 0.0000 4.6250 9.500014.000020.250022.500024.500025.250025.750025.8750  Z17
26.000025.750025.125024.375023.000020.500017.875012.5000 8.1250 4.0000  Z17
 0.0000
23.600023.600023.600023.600023.600025.850030.600035.350039.850044.1000  Y18
48.350052.350056.475060.850064.975068.850071.350072.850073.100073.1000  Y18
73.1000
 0.0000 3.8750 9.250014.000019.500021.750023.625024.250024.375024.5000  Z18
24.500024.375024.250023.625022.250019.750016.000012.0000 7.8750 3.7500  Z18
 0.0000
23.000023.000023.000023.000023.000025.250029.750034.625039.000043.1250  Y19
47.000050.750055.000059.000063.000 67.0   69.5   71.0   71.5   71.5     Y19
71.5
 0.0000 3.7500 9.250013.24  19.00  21.25  22.50  23.25  23.625 23.75     Y19
                                                                         Y20
```

FIGURE 8 CONT'D

```
24.00   23.75   23.50   22.75   21.75   19.25   15.75   12.00    7.75   3.75      Y20
 0.0000                                                                           Y20
22.600022.600022.600022.600022.600024.850029.350034.100038.975042.2250  Z20
46.350050.100054.225058.350062.225065.850068.350069.600070.100070.1000  Z20
70.1000                                                                          Z20
 0.0000 3.6250 8.750013.000018.500020.250021.250021.625021.750021.8750  Y21
22.000021.875021.625021.000019.750017.625014.750011.2500 7.2500 3.5000  Y21
 0.0000                                                                          Y21
23.25   23.25   23.25   23.25   23.25   25.50   30.37   34.87   38.875 42.5      Z21
46.000049.500053.125056.750060.250063.750066.500068.000068.500068.5000  Z21
68.5000                                                                          Z21
 0.0000 4.5000 8.375012.500017.750018.500019.250019.625019.875020.0000  Y22
20.000019.750019.625019.375018.625017.000014.250010.7500 7.0000 3.3750  Y22
 0.0000                                                                          Y22
24.000024.000024.000024.000024.000027.000031.500035.500039.000042.375   Z22
45.500048.625052.000055.375059.000062.500065.125066.625067.000067.0000  Z22
67.                                                                              Z22
 0.0000 4.0000 8.000012.300016.700017.350018.000018.250018.400018.4500  Y23
18.500018.400018.100017.600017.100015.900013.500010.1500 6.6000 3.2000  Y23
 0.0000                                                                          Y23
25.500025.500025.500025.500025.500028.100032.400036.150039.500042.5500  Z23
45.500048.400051.400054.500057.900061.400064.100065.400065.500065.5000  Z23
65.5000                                                                          Z23
 0.0000 4.0000 8.000010.000015.550016.000016.400016.600016.610016.6200  Y24
16.625016.600016.400016.050015.400014.150012.0000 9.1000 6.0000 2.9000  Y24
 0.0000                                                                          Y24
27.25   27.25   27.25   27.25   27.25   29.5    33.55   37.     40.     42.85    Z24
45.5    48.1    50.9    53.7    56.7    59.65   62.05   63.4    63.7    63.72    Z24
63.75                                                                            Z24
 0.0000 4.3750 7.625011.125013.875014.375014.688014.813014.875014.9380  Y25
15.000014.875014.813014.375014.000012.875010.9380 8.3750 5.4375 2.6875  Y25
 0.0000                                                                          Y25
28.420028.420028.420028.420029.400031.775034.400037.650040.275042.7750  Z25
45.212547.525049.962552.525055.275057.900060.025061.275061.713061.9000  Z25
61.9630                                                                          Z25
 0.0000 2.4000 4.8000 7.600011.400012.150012.500012.650012.800012.9000  Y26
13.000012.800012.500012.100011.500010.6000 9.2000 7.1000 4.8000 2.4000  Y26
 0.0000                                                                          Y26
30.000030.000030.000030.000030.000032.900035.900038.500040.800042.9000  Z26
45.000047.000049.100051.200053.400055.600057.600059.000059.600059.9000  Z26
60.0000                                                                          Z26
 0.0000 1.8125 3.8125 6.0000 7.8750 9.1250 9.5000 9.6875 9.8125 9.8750  Y27
 9.8750 9.8125 9.7500 9.5000 9.2500 8.5625 7.3750 5.7500 3.8125 1.8750  Y27
 0.0000                                                                          Y27
33.101 33.101 33.101 33.187 34.125 35.875 38.     40.125 41.875 43.5      Z27
45.063 46.625 48.25  49.875 51.813 53.563 55.188 56.375 57.0   57.188   Z27
57.25                                                                            Z27
 0.0000 1.6000 3.2500 4.8500 6.3000 6.9500 7.3500 7.4000 7.4500 7.5000  Y28
 7.5000 7.4000 7.2000 7.0000 6.6000 6.1000 5.4000 4.3000 3.1000 1.6000  Y28
 0.0000                                                                          Y28
35.500035.500035.500036.000037.300038.550040.200041.700043.000044.3000  Z28
45.500046.700047.900049.100050.300051.600052.900053.950054.750055.3000  Z28
55.5000                                                                          Z28
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000  Y29
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000  Y29
 0.0000                                                                          Y29
43.250043.250043.250043.250043.250043.250043.250043.250043.250043.2500  Z29
43.250043.250043.250043.250043.250043.250043.250043.250043.250043.2500  Z29
43.2500                                                                          Z29
X Z OUT  45. 10.   30.                          14. ORT                      1
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FIGURE 8 CONT'D

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ATLIT NACELLE WITH N=21 AND M=21 YIELDING 400 PANELS ON THE BODY
         1                        1 21 21
0.0     1.5     3.75    6.75    11.25   15.0    20.0    24.5    30.0    34.5      XFUS10
40.0    45.75   51.0    56.5    62.5    68.5    74.     79.5    86.0    94.5      XFUS20
116.0                                                                            XFUS21
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000           Y1
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000           Y1
 0.0000                                                                          Y1
26.500026.500026.500026.500026.500026.500026.500026.500026.500026.5000          Z1
26.500026.500026.500026.500026.500026.500026.500026.500026.500026.5000          Z1
26.5000                                                                          Z1
 0.0000 1.5000 2.9500 4.5000 6.5000 8.875011.875015.320016.875017.3750           Y2
17.625017.750017.420014.750011.5000 8.6250 6.3750 4.5000 2.9200 1.3750           Y2
 0.0000                                                                          Y2
18.000018.000018.000018.000018.080018.125018.300019.125021.500024.2500          Z2
27.000029.800032.625034.500035.375035.625035.750035.875035.900035.9500          Z2
36.0000                                                                          Z2
 0.0000 1.5000 3.3750 5.2500 7.125010.125013.500016.500017.750018.0000           Y3
18.125018.250018.125016.000012.8750 9.8750 7.3750 5.1250 3.3750 1.6250           Y3
 0.0000                                                                          Y3
16.000016.000016.000016.000016.000016.120016.375017.750020.375023.3750          Z3
26.250029.125032.250034.375035.625036.125036.250036.375036.500036.5000          Z3
36.5000                                                                          Z3
 0.     1.703   3.453   5.375   7.719   10.438 13.5    16.25   17.813 18.438    Y4
18.75   18.719 18.234 16.578 13.719 10.672 8.      5.594   3.625   1.7813        Y4
0.                                                                               Y4
14.688 14.719 14.813 14.904 15.03   15.28   15.875 17.438 19.922 22.75           Z4
25.813 28.625 31.688 34.125 35.438 36.078 36.406 36.625 36.703 36.75           Z4
36.78                                                                            Z4
 0.0000 1.7813 3.6250 5.6563 8.000010.750013.875016.688018.125018.7190          Y5
18.938019.000018.625017.000014.156011.0000 8.2500 5.8750 3.5635 1.8750          Y5
 0.0000                                                                          Y5
14.6    14.6    14.631 14.694 14.819 15.069 15.788 17.406 20.     22.938        Z5
26.063 28.969 32.025 34.744 36.275 37.025 37.337 37.525 37.588 37.619           Z5
37.619                                                                           Z5
 0.0000 1.7813 3.6250 5.6563 8.000010.750013.875016.688018.125018.7190          Y6
18.938019.000018.625017.000014.156011.0000 8.2500 5.8750 3.5635 1.8750          Y6
 0.0000                                                                          Y6
14.750014.750014.781214.843714.968715.218715.937517.656220.250023.1875          Z6
26.312529.218832.375035.094036.625037.375037.687037.875037.938037.9690          Z6
37.9690                                                                          Z6
 0.0000 1.8750 3.7810 5.9060 8.375011.187014.313016.812018.250018.7190          Y7
18.938019.000018.718017.250014.250011.0620 8.6880 5.9380 3.7500 1.8750          Y7
 0.0000                                                                          Y7
14.844014.844014.875014.907015.000015.312016.157018.000020.625023.6880          Z7
26.625029.812032.750035.406037.125037.812038.156038.312038.344038.3440          Z7
38.3750                                                                          Z7
 0.0000 1.8750 3.7810 5.9060 8.375011.187014.313016.812018.250018.7190          Y8
18.938019.000018.718017.250014.250011.0620 8.6880 5.9380 3.7500 1.8750          Y8
 0.0000                                                                          Y8
15.094015.094015.125015.157015.250015.562016.407018.250020.875023.9380          Z8
26.875030.062033.000035.656037.375038.062038.406038.562038.594038.5940          Z8
38.6250                                                                          Z8
 0.0000 1.7500 3.7188 5.8438 8.312511.240014.281016.688018.000018.6250          Y9
18.906019.000018.813017.438014.500011.1560 8.2813 5.8750 3.7188 1.7500          Y9
 0.0000                                                                          Y9
15.500015.500015.500015.500015.500015.719016.562018.531021.250024.3120          Z9
27.125030.250033.312536.156037.719038.375038.625038.719038.750038.7800          Z9
38.8750                                                                          Z9
 0.0000 1.7500 3.7188 5.8438 8.312511.240014.281016.688018.000018.6250          Y10
18.906019.000018.813017.438014.500011.1560 8.2813 5.8750 3.7188 1.7500          Y10
 0.0000                                                                          Y10
15.625015.625015.625015.625015.625015.844016.687018.656021.375024.4370          Z10
27.250030.375033.437536.281037.844038.500038.750038.844038.875038.9050          Z10
39.0000                                                                          Z10
```

FIGURE 9

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 0.0000 1.7188 3.7188 6.1250 8.312511.468014.406016.656017.750018.4380  Y11
18.813019.000018.813017.375014.125010.7190 7.9375 5.6563 3.5938 1.7500  Y11
 0.0000                                                                 Y11
16.125016.125016.125016.125016.125016.125016.719018.937021.719024.5000  Z11
27.500030.562533.750036.313037.875038.375038.563038.656038.688038.6880  Z11
38.7190                                                                 Z11
 0.0000 1.7188 3.7188 6.1250 8.312511.468014.406016.656017.750018.4380  Y12
18.813019.000018.813017.375014.125010.7190 7.9375 5.6563 3.5938 1.7500  Y12
 0.0000                                                                 Y12
16.000016.000016.000016.000016.000016.000016.000016.594018.812021.594024.3750  Z12
27.375030.437533.625036.188037.750038.250038.438038.531038.563038.5630  Z12
38.5940                                                                 Z12
 0.0000 1.7188 3.7188 6.1250 8.312511.468014.406016.656017.750018.4380  Y13
18.813019.000018.813017.375014.125010.7190 7.9375 5.6563 3.5938 1.7500  Y13
 0.0000                                                                 Y13
16.406 16.406 16.406 16.406 16.406 16.406 16.95  19.156 21.9   24.63    Z13
27.5   30.494 33.63  36.144 37.656 38.156 38.344 38.438 38.469 38.469   Z13
38.5                                                                    Z13
 0.0000 1.6250 3.2500 5.1250 7.250010.000013.500017.0   18.5   19.0000  Y14
19.000019.000019.000017.5   13.625010.0000 7.2500 5.1250 3.25001.625    Y14
 0.0000                                                                 Y14
17.500017.570017.620017.620017.670017.750017.830018.625021.500024.625   Z14
27.750030.750033.875036.875037.700037.750037.830037.875037.930038.0000  Z14
38.0000                                                                 Z14
 0.0000 1.6250 3.2500 4.8750 7.1250 9.625013.000016.755018.625018.7500  Y15
18.800018.875019.000016.85  13.1250 9.6250 7.0000 5.0000 3.1250 1.6250  Y15
 0.0000                                                                 Y15
18.000018.000018.000018.000018.000018.075018.125018.875021.625024.7500  Z15
27.7500 30.750034.000036.500037.250037.350037.375037.400037.450037.5000  Z15
37.5000                                                                 Z15
 0.0000 1.3750 3.0000 4.5000 6.5000 8.875012.000016.375018.625018.7500  Y16
18.800018.875019.000016.000011.8750 8.7500 6.3750 4.5000 2.8750 1.5000  Y16
 0.0000                                                                 Y16
18.500018.500018.500018.580018.600018.625018.750019.000021.375024.5000  Z16
27.500030.500033.750035.625036.125036.250036.300036.375036.420036.4500  Z16
36.5000                                                                 Z16
 0.0000 1.3750 2.7500 4.1250 6.0000 8.125011.125015.125018.500018.6250  Y17
18.7500 18.875018.500014.875011.0000 8.1250 6.0000 4.1250 2.6250 1.3750  Y17
 0.0000                                                                 Y17
19.250019.250019.250019.250019.250019.300019.375019.625021.375024.5000  Z17
27.500030.500033.500035.000035.375035.500035.625035.650035.700035.7500  Z17
35.7500                                                                 Z17
 0.0000 1.1250 2.3750 3.6250 5.2500 7.1250 9.625013.250017.750018.5000  Y18
18.500018.500018.000013.5000 9.6250 7.1250 5.1250 3.6250 2.2500 1.1250  Y18
 0.0000                                                                 Y18
20.3   20.3   20.3   20.3   20.375 20.375 20.5   20.75  21.68  24.5     Z18
27.5   30.375 33.32  34.375 34.5   34.56  34.625 34.64  34.7   34.75    Z18
34.75                                                                   Z18
 0.0000 1.0000 2.0000 3.0000 4.2500 5.7500 8.000011.125015.875017.7500  Y19
17.750017.750015.750011.3750 8.0000 5.8750 4.2500 3.0000 1.8750 0.8750  Y19
 0.0000                                                                 Y19
21.    21.05  21.05  21.05  21.05  21.125 21.2   21.25  21.75  24.125   Z19
27.    29.75  32.125 32.75  32.8   32.85  32.875 32.9   32.95  33.      Z19
33.                                                                     Z19
 0.0000 1.2500 3.0000 4.7500 6.7500 9.375011.625014.125015.0   15.3750  Y20
15.375015.375015.375014.125011.6250 9.3750 6.7500 4.7500 3.0000 1.2500  Y20
 0.0000                                                                 Y20
22.750022.760022.770022.790022.810022.850022.875022.950023.500025.2500  Z20
26.750028.250030.000030.550030.625030.650030.690030.710030.730030.7400  Z20
30.7500                                                                 Z20
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000  Y21
 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000  Y21
 0.0000                                                                 Y21
26.500026.500026.500026.500026.500026.500026.500026.500026.500026.5000  Z21
26.500026.500026.500026.500026.500026.500026.500026.500026.500026.5000  Z21
26.5000                                                                 Z21
X Z OUT  45. 10.   30.                        12. ORT                 1
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FIGURE 9 CONT'D

POTENTIAL FLOW PROGRAM SECTION 1

ATLIT WITH M=21 AND N=29 YIELDING 560 PANELS -- FUSELAGE ONLY

NO. OF QUADS. = 560
NO. OF SECTIONS= 1
MAX. NO. OF ITERATIONS X FLOW 150

VINF = 160.000000 VO = 0.000160 ROE = 0.002378
REFA = 155.000000 IWRITE = 2

1 PLANES OF SYMMETRY

CONVERGENCE CRITERIA . 0.00010

PRESSURE LIFT AND DRAG COEFFICIENTS

PRESSURE CL =	0.00329
PRESSURE CD =	0.00222
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.2825E 08

FRICTION DRAG COEFFICIENT

FRICTION CD =	0.01057
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.2825E 08
BODY LENGTH =	28.25000

TOTAL BODY COEFFICIENTS

TOTAL BODY CL =	0.00300
TOTAL BODY CD =	0.01299
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.2825E 08
BODY LENGTH =	28.25000

FIGURE 10

POTENTIAL FLOW PROGRAM SECTION 1

ATLIT NACELLE WITH N=21 AND M=21 YIELDING 400 PANELS ON THE BODY

NO. OF QUADS. = 400
NO. OF SECTIONS= 1
MAX. NO. OF ITERATIONS X FLOW 150

VINF = 160.000000 VO = 0.000160 ROE = 0.002378
REFA = 155.000000 IWRITE = 2

1 PLANES OF SYMMETRY

CONVERGENCE CRITERIA . 0.00010

PRESSURE LIFT AND DRAG COEFFICIENTS

PRESSURE CL =	0.00230
PRESSURE CD =	0.00391
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.9667E 07

FRICTION DRAG COEFFICIENT

FRICTION CD =	0.00308
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.9667E 07
BODY LENGTH =	9.66667

TOTAL BODY COEFFICIENTS

TOTAL BODY CL =	0.00235
TOTAL BODY CD =	0.00722
REFERENCE AREA =	155.00000
REYNOLDS NUMBER =	0.9667E 07
BODY LENGTH =	9.66667

FIGURE 11

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Protuberances

No accounting for the drag due to protuberances was deemed necessary in the drag buildup since the probable magnitude of these effects is within the uncertainty bounds of the nacelle, fuselage, and interference drag computations.

Calculated and Estimated Lift-Drag Polar

As shown in Table I, summing the results of the previous calculations yields a drag polar represented by the equation

$$C_D = .035832 + .040561\ C_L^{1.94} . \qquad (1)$$

This polar, as indicated previously, does not include the effects of flow separations at the higher lift coefficients. In an effort to develop a more accurate polar upon which to base performance estimates, full scale wind tunnel test data on a similar aircraft (Ref. 5) were examined and fitted by the equation

$$C_D = 0.035 + 0.051\ C_L^{2} + 0.00138\ C_L^{13.42} . \qquad (2)$$

Plots of these equations are shown in figure 12. Note that the two curves differ little for $C_L < 0.8$. Above $C_L = 0.8$ it is to be expected that equation (2) will more nearly represent the behavior of the ATLIT than equation (1). Despite the fact that equation (2) describes the drag of an unpowered airplane and that drag under some conditions of powered flight may exceed the drag in unpowered flight, equations (1) and (2) were treated as the probable boundaries for the actual ATLIT drag polar. Because of the relatively smaller ATLIT wing area (compared with the aircraft tested in Ref. 5) it is not expected that the ATLIT drag will rise as rapidly with increasing C_L as it does for the aircraft of Ref. 5. Thus, even if the ATLIT drag in powered flight is somewhat greater than in unpowered flight, the drag should be below the boundary given by equation (2).

TABLE I ATLIT DRAG BUILDUP

C.G. @ 26.5% MAC

α_{wing}	$C_{L_{wing}}$	TRIM C_{L_t} S_t/S_w	C_{D_t} S_t/S_w	C_{D_w}	$C_{D_{TOTAL}}$	C_L
-4	-.134569	-.003474	.001879	.007316	.038473	-.138043
-2	.063437	.001638	.001852	.006045	.037175	.065075
0	.259752	.006707	.0019772	.008349	.039604	.266459
2	.454464	.011736	.00200	.014132	.04541	.4662
4	.648280	.016741	.00210	.023051	.054429	.66502
6	.841217	.021724	.002184	.034891	.066353	.86294
8	1.032682	.02666	.002265	.049506	.081049	1.05934
10	1.221700	.031549	.002346	.066789	.098413	1.25324
12	1.405880	.036306	.002424	.086509	.118211	1.442
14	1.582697	.040872	.002618	.108327	.140223	1.6235

$C_{D_{TOTAL}} = C_{D_w} + C_{D_t} S_t/S_w + C_{D_{t_v}} S_v/S_w + C_{D_{fus}} + 2\, C_{D_{NACELLE}}$

$= C_{D_w} + C_{D_t} S_t/S_w + .0018487 + .01299 + 2(.00722)$

$= C_{D_w} + C_{D_t} S_t/S_w + .0292787$

$C_L = C_{L_w} + C_{L_t} S_t/S_w$

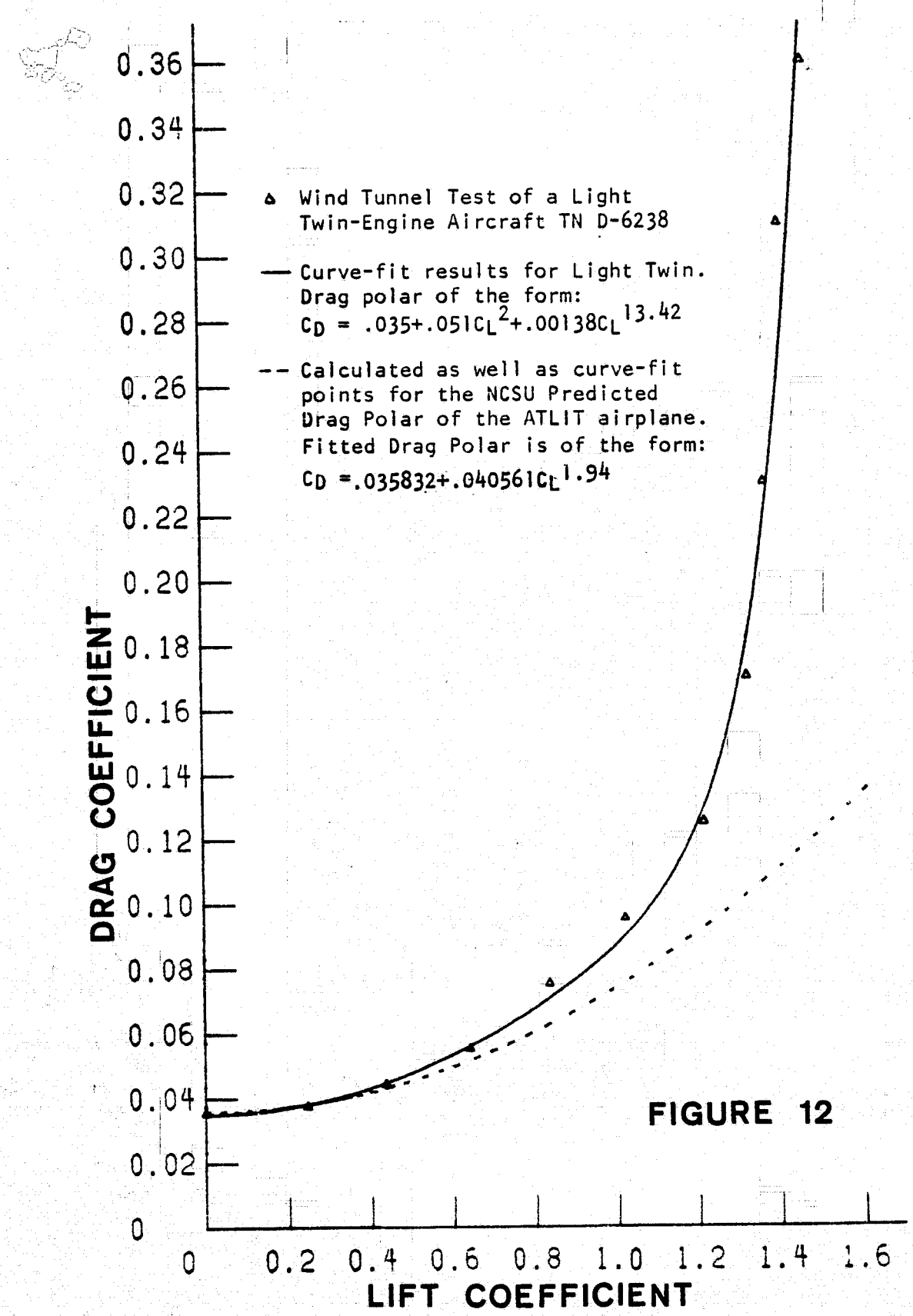

0.36
0.34
0.32
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
DRAG COEFFICIENT
Wind Tunnel Test of a Light Twin-Engine Aircraft TN D-6238
Curve-fit results for Light Twin. Drag polar of the form: $C_D = .035+.051C_L^{2}+.00138C_L^{13.42}$
Calculated as well as curve-fit points for the NCSU Predicted Drag Polar of the ATLIT airplane. Fitted Drag Polar is of the form: $C_D = .035832+.040561C_L^{1.94}$
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
LIFT COEFFICIENT

FIGURE 12

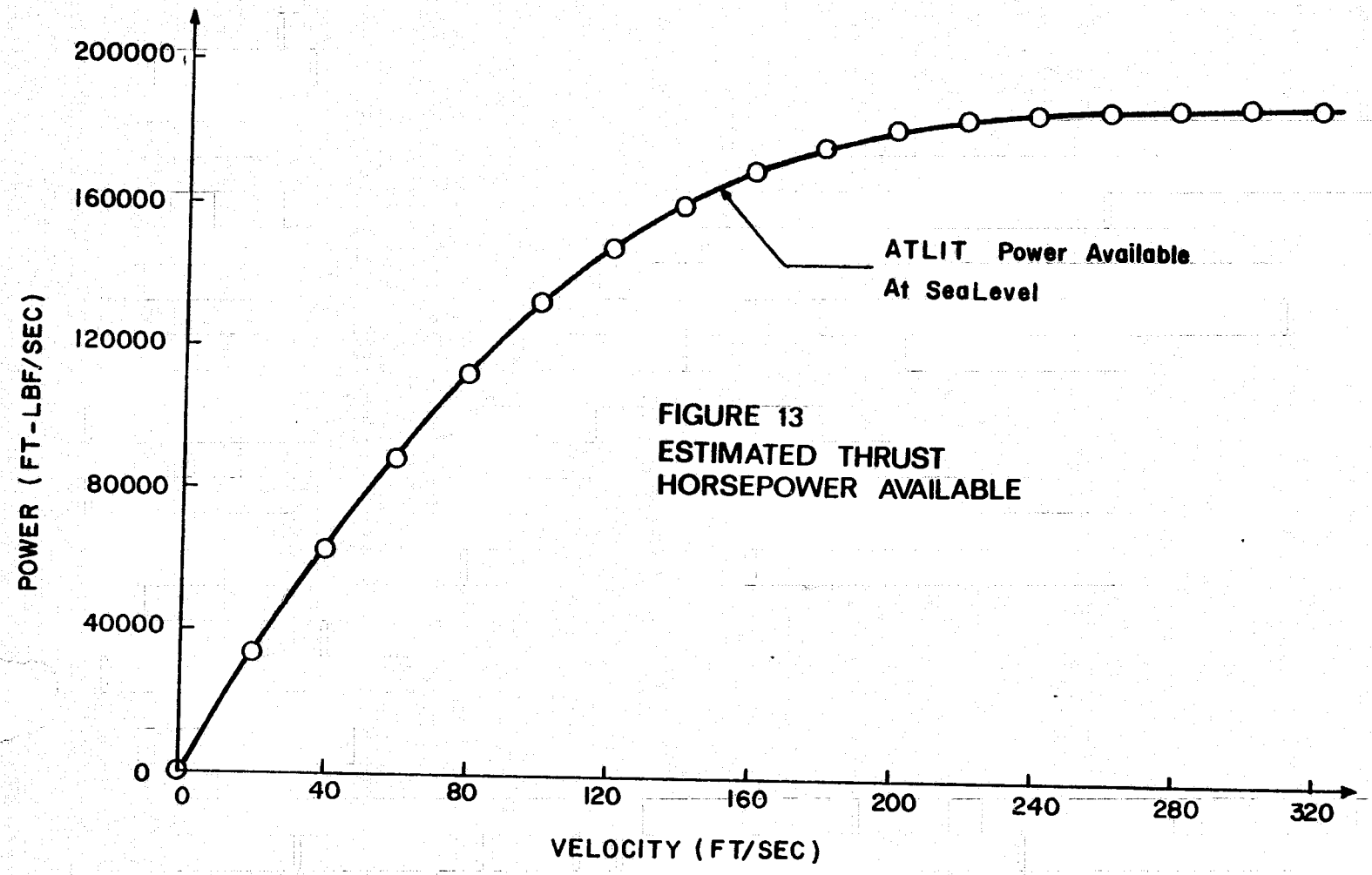


FIGURE 13
ESTIMATED THRUST
HORSEPOWER AVAILABLE

PERFORMANCE PREDICTIONS

The drag polars given by equations (1) and (2) were submitted to the point performance program described in Ref. 2 along with the thrust horsepower data given in figure 13. The latter were derived from engine test cell data and propeller performance charts. They do not include any installation-dependent effects. The data given in Table II represent the output of this program. It will be noted that, compared with the original Seneca, only small improvements in rate-of-climb and cruise speed are expected. This can be explained by the fact that although the airfoil itself offers about a 10% improvement in L/D at C_L = 0.8 (the nominal C_L for climb) the wing is responsible for only about 40% of the total drag. Overall aircraft drag is, as a result, only about 4% lower.

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TABLE II . COMPARISON OF PREDICTED ATLIT PERFORMANCE USING THRUST HORSEPOWER DATA SHOWN IN FIG. 13 WITH PIPER SENECA

Performance characteristics	Predicted using light-twin polar from wind tunnel tests (TND-6238) 4200 lbs	Piper Seneca	Predicted using NCSU parabolic polar 4200 lbs
Max. level flight speed (ft/sec)	300.00	286.0	298.9
Min. level flight speed (ft/sec)	123.7	101.2	47.23
Max. rate of climb (ft/sec)	27.1	22.67	28.35
Single engine rate of climb (ft/sec)*	6.06	3.167	7.81
Best rate of climb speed (ft/sec)	168.2	154.0	162.76
Best single engine rate of climb speed (ft/sec)*	155.8	154.0	144.07
Maximum climb angle (degrees)	10.17		12.34°
Maximum climb angle speed (ft/sec)	144.5	132.0	105.42
Best range speed (ft/sec)	167.0	160.0	153.48
Service ceiling (ft)	19,681	18,000	22,525
Absolute ceiling (ft)	21,077	19,400	24,157
Single engine service ceiling (ft)	5,623	3,650	8,852
Single engine absolute ceiling (ft)	7,791	5,000	11,353

* Single engine characteristics were computed using a $C_D = 1.05C_D$ to account for the vertical tail drag and half the estimated power.

STABILITY PREDICTIONS

The stability predictions for the ATLIT were developed using the aircraft's geometric and inertial parameters and the computer programs described in Ref. 3. The input data and results are shown in figures 14 through 17 and 18 through 21.

PERTINENT AIRPLANE CHARACTERISTICS

DENSITY (SLUGS/FT**3)	= 0.00199	VELOCITY (FT/SEC)	= 286.00000
MASS (SLUGS)	= 124.22400	IYY (SLUG-FT**2)	=2560.00000
THRUST (POUNDS)	= 0.0	ZJ (FT)	= 0.0
G*COS(GAMMA) (FT/SEC/SEC)	= 32.00000	G*SIN(GAMMA) (FT/SEC/SEC)	= 0.0
COS(XZ)	= 1.00000	SIN(XZ)	= 0.0
WING AREA (FT**2)	= 155.00000	HORZ. TAIL AREA (FT**2)	= 38.74300
WING SPAN (FT)	= 39.70000	HORZ. TAIL SPAN (FT)	= 13.56000
WING CHORD (FT)	= 4.11000	HORZ. TAIL CHORD (FT)	= 2.85715
WING ASPECT RATIO	= 10.16832	HORZ. TAIL ASPECT RATIO	= 4.76598
WING TAPER RATIO	= 0.50000	HORZ. TAIL TAPER RATIO	= 1.00000
WING ALPHA (DEGREES)	= 0.22900	TAIL ALPHA (DEGREES)	= -1.63372
IWING (DEGREES)	= 0.50000	ITAIL (DEGREES)	= 0.0
DOWNWASH ANGLE (DEGREES)	= 1.36272	DOWNWASH/ALPHA	= 0.42627
ELEVATOR ANGLE (DEGREES)	= 1.63372	ELEVATOR AREA (FT**2)	= 38.74300
TAIL EFFICIENCY	= 0.90000	ELEVATOR CHORD (FT)	= 2.85715
2-D WING CLA	= 0.12163	2-D TAIL CLA	= 0.11500
CDPIE	= 0.03510	2-D WING CDA	= 0.04670
2-D WING CL	= 0.37984		

DISTANCES

LENGTH OF FUSELAGE (FT)	= 27.67000	WIDTH OF FUSELAGE (FT)	= 4.33000
C.G. TO TAIL QUARTER-CHORD (FT)	= 16.00000	WING TO TAIL QUARTER-CHORD (FT)	= 16.00000
C.G. TO WING A.C.(CHORDWISE) (FT)	= 0.0	C.G. TO WING A.C.(VERTICAL) (FT)	= 0.0
NOSE TO WING QUARTER-CHORD (FT)	= 10.25300	C.G. TO WING QUARTER-CHORD (FT)	= 0.0
C.G. TO THRUST AXIS (FT)	= 0.0		

LONGITUDINAL STABILITY DERIVATIVES

CL = 0.3174	CLA = 5.6891	CLOA = 3.2591	CLQ = 7.6455	CLDE = 0.9419	CLU = 0.0	CT = 0.0
CD = 0.0383	CDA = 0.1610	CDDA = 0.0	CDQ = 0.0	CDDE = 0.0	CDU = 0.0	CTU = 0.0
CM = 0.0	CMA = -1.5001	CMDA =-12.6873	CMQ =-29.7635	CMDE = -3.6667	CMU = 0.0	CTRPM = 0.0

DENOMINATOR ROOTS

ROOT(1) =	-0.01279	+J	-0.14030
ROOT(2) =	-0.01279	+J	0.14030
ROOT(3) =	-4.07258	+J	-4.65815
ROOT(4) =	-4.07258	+J	4.65815

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
SHORT PERIOD	6.18742	4.65815	0.65820	0.17020	0.73558
PHUGOID	0.14089	0.14030	0.09076	54.20667	234.27487

FIGURE 14

PERTINENT AIRPLANE CHARACTERISTICS

DENSITY (SLUGS/FT**3)	= 0.00199	VELOCITY (FT/SEC)	= [illegible].00000
MASS (SLUGS)	= 124.22400	IYY (SLUG-FT**2)	=2[illegible]0.00000
THRUST (POUNDS)	= 0.0	ZJ (FT)	= 0.0
G*COS(GAMMA) (FT/SEC/SEC)	= 32.00000	G*SIN(GAMMA) (FT/SEC/SEC)	= 0.0
COS(XZ)	= 1.00000	SIN(XZ)	= 0.0
WING AREA (FT**2)	= 182.73000	HORZ. TAIL AREA (FT**2)	= 38.74300
WING SPAN (FT)	= 39.70000	HORZ. TAIL SPAN (FT)	= 13.56000
WING CHORD (FT)	= 4.75000	HORZ. TAIL CHORD (FT)	= 2.85715
WING ASPECT RATIO	= 8.62524	HORZ. TAIL ASPECT RATIO	= 4.74598
WING TAPER RATIO	= 0.50000	HORZ. TAIL TAPER RATIO	= 1.00000
WING ALPHA (DEGREES)	= 0.22900	TAIL ALPHA (DEGREES)	= -1.81752
IWING (DEGREES)	= 0.50000	ITAIL (DEGREES)	= 0.0
DOWNWASH ANGLE (DEGREES)	= 1.54652	DOWNWASH/ALPHA	= 0.46215
ELEVATOR ANGLE (DEGREES)	= 1.81752	ELEVATOR AREA (FT**2)	= 38.74300
TAIL EFFICIENCY	= 0.90000	ELEVATOR CHORD (FT)	= 2.85715
2-D WING CLA	= 0.12163	2-D TAIL CLA	= 0.11500
COPIE	= 0.03510	2-D WING CDA	= 0.04670
2-D WING CL	= 0.37984		

DISTANCES

LENGTH OF FUSELAGE (FT)	= 27.67000	WIDTH OF FUSELAGE (FT)	= 4.33000
C.G. TO TAIL QUARTER-CHORD (FT)	= 16.00000	WING TO TAIL QUARTER-CHORD (FT)	= 16.00000
C.G. TO WING A.C.(CHORDWISE) (FT)	= 0.0	C.G. TO WING A.C.(VERTICAL) (FT)	= 0.0
NOSE TO WING QUARTER-CHORD (FT)	= 10.25500	C.G. TO WING QUARTER-CHORD (FT)	= 0.0
C.G. TO THRUST AXIS (FT)	= 0.0		

LONGITUDINAL STABILITY DERIVATIVES

CL = 0.3083	CLA = 5.5081	CLDA = 2.7055	CLQ = 5.6115	CLDE = 0.7989	CLU = 0.0	CT = 0.0
CD = 0.0386	CDA = 0.1735	CDDA = 0.0	CDQ = 0.0	CDDE = 0.0	CDU = 0.0	CTU = 0.0
CM = 0.0	CMA = -0.3582	CMDA = -9.1134	CMQ = -18.9018	CMDE = -2.6912	CMU = 0.0	CTRPM = 0.0

DENOMINATOR ROOTS

ROOT(1) =	-0.01610	+J	-0.11915
ROOT(2) =	-0.01610	+J	0.11915
ROOT(3) =	-4.33009	+J	-0.90362
ROOT(4) =	-4.33009	+J	0.90362

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
SHORT PERIOD	4.42337	0.90362	0.97891	0.16008	0.69183
PHUGOID	0.12023	0.11915	0.13393	43.04546	186.03745

FIGURE 15

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PERTINENT AIRPLANE CHARACTERISTICS

DENSITY (SLUGS/FT**3)	= 0.00238	VELOCITY (FT/SEC)	= 161.00000
MASS (SLUGS)	= 124.22400	IYY (SLUG-FT**2)	=2560.00000
THRUST (POUNDS)	= 0.0	ZJ (FT)	= 0.0
G*COS(GAMMA) (FT/SEC/SEC)	= 32.03800	G*SIN(GAMMA) (FT/SEC/SEC)	= 3.22000
COS(XZ)	= 1.00000	SIN(XZ)	= 0.0
WING AREA (FT**2)	= 155.00000	HORZ. TAIL AREA (FT**2)	= 38.74300
WING SPAN (FT)	= 39.70000	HORZ. TAIL SPAN (FT)	= 13.56000
WING CHORD (FT)	= 4.11000	HORZ. TAIL CHORD (FT)	= 2.85715
WING ASPECT RATIO	= 10.16832	HORZ. TAIL ASPECT RATIO	= 4.74598
WING TAPER RATIO	= 0.50000	HORZ. TAIL TAPER RATIO	= 1.00000
WING ALPHA (DEGREES)	= 5.60050	TAIL ALPHA (DEGREES)	= 1.51893
IWING (DEGREES)	= 0.50000	ITAIL (DEGREES)	= 0.0
DOWNWASH ANGLE (DEGREES)	= 3.58157	DOWNWASH/ALPHA	= 0.41020
ELEVATOR ANGLE (DEGREES)	= -1.51893	ELEVATOR AREA (FT**2)	= 38.74300
TAIL EFFICIENCY	= 0.90000	ELEVATOR CHORD (FT)	= 2.85715
2-D WING CLA	= 0.11606	2-D TAIL CLA	= 0.11500
COPIE	= 0.03510	2-D WING CDA	= 0.03603
2-D WING CL	= 0.99830		

DISTANCES

LENGTH OF FUSELAGE (FT)	= 27.67000	WIDTH OF FUSELAGE (FT)	= 4.33000
C.G. TO TAIL QUARTER-CHORD (FT)	= 16.00000	WING TO TAIL QUARTER-CHORD (FT)	= 16.00000
C.G. TO WING A.C.(CHORDWISE) (FT)	= 0.0	C.G. TO WING A.C.(VERTICAL) (FT)	= 0.0
NOSE TO WING QUARTER-CHORD (FT)	= 10.25500	C.G. TO WING QUARTER-CHORD (FT)	= 0.0
C.G. TO THRUST AXIS (FT)	= 0.0		

LONGITUDINAL STABILITY DERIVATIVES

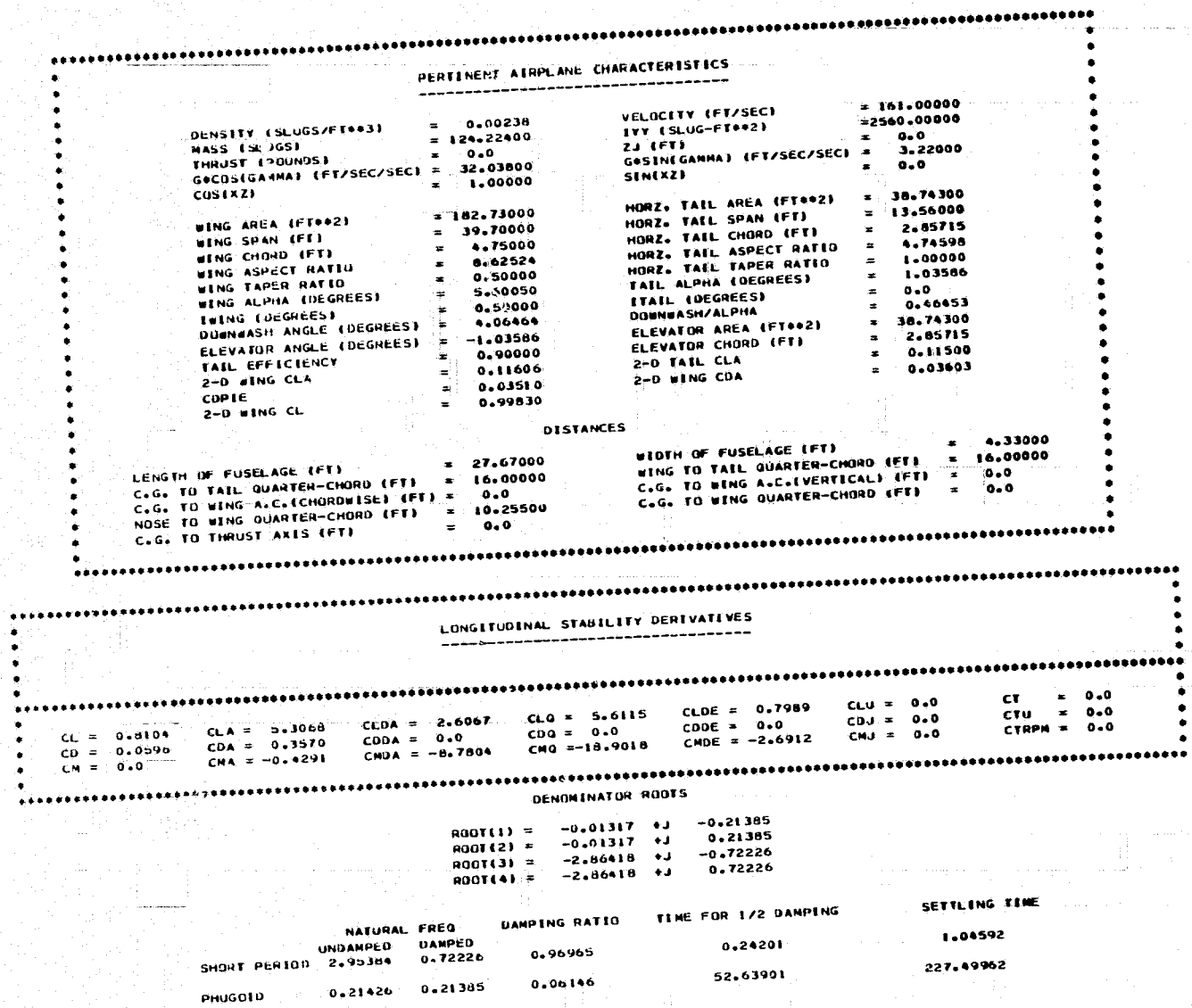
CL = 0.8342	CLA = 5.4747	CLDA = 3.1362	CLQ = 7.6455	CLDE = 0.9419	CLU = 0.0	CT = 0.0
CD = 0.0571	CDA = 0.3251	CDDA = 0.0	CDQ = 0.0	CDDE = 0.0	CDU = 0.0	CTU = 0.0
CM = 0.0	CMA = -1.5615	CMDA =-12.2090	CMQ =-29.7635	CMDE = -3.6667	CMU = 0.0	CTRPM = 0.0

DENOMINATOR ROOTS

ROOT(1) =	-0.00293	+J	-0.24574
ROOT(2) =	-0.00293	+J	0.24574
ROOT(3) =	-2.70232	+J	-2.86218
ROOT(4) =	-2.70232	+J	2.86218

	NATURAL FREQ		DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
	UNDAMPED	DAMPED			
SHORT PERIOD	3.93632	2.86218	0.68651	0.25650	1.10857
PHUGOID	0.24576	0.24574	0.01192	236.65381	1022.79003

FIGURE 16



PERTINENT AIRPLANE CHARACTERISTICS

DENSITY (SLUGS/FT**3)	= 0.00238	VELOCITY (FT/SEC)	= 161.00000
MASS (SLUGS)	= 124.22400	IYY (SLUG-FT**2)	=2560.00000
THRUST (POUNDS)	= 0.0	ZJ (FT)	= 0.0
G*COS(GAMMA) (FT/SEC/SEC)	= 32.03800	G*SIN(GAMMA) (FT/SEC/SEC)	= 3.22000
COS(XZ)	= 1.00000	SIN(XZ)	= 0.0
WING AREA (FT**2)	= 182.73000	HORZ. TAIL AREA (FT**2)	= 38.74300
WING SPAN (FT)	= 39.70000	HORZ. TAIL SPAN (FT)	= 13.56000
WING CHORD (FT)	= 4.75000	HORZ. TAIL CHORD (FT)	= 2.85715
WING ASPECT RATIO	= 8.62524	HORZ. TAIL ASPECT RATIO	= 4.74598
WING TAPER RATIO	= 0.50000	HORZ. TAIL TAPER RATIO	= 1.00000
WING ALPHA (DEGREES)	= 5.50050	TAIL ALPHA (DEGREES)	= 1.03586
IWING (DEGREES)	= 0.50000	ITAIL (DEGREES)	= 0.0
DOWNWASH ANGLE (DEGREES)	= 4.06464	DOWNWASH/ALPHA	= 0.46653
ELEVATOR ANGLE (DEGREES)	= -1.03586	ELEVATOR AREA (FT**2)	= 38.74300
TAIL EFFICIENCY	= 0.90000	ELEVATOR CHORD (FT)	= 2.85715
2-D WING CLA	= 0.11606	2-D TAIL CLA	= 0.11500
COPIE	= 0.03510	2-D WING CDA	= 0.03603
2-D WING CL	= 0.99830		

DISTANCES

LENGTH OF FUSELAGE (FT)	= 27.67000	WIDTH OF FUSELAGE (FT)	= 4.33000
C.G. TO TAIL QUARTER-CHORD (FT)	= 16.00000	WING TO TAIL QUARTER-CHORD (FT)	= 16.00000
C.G. TO WING A.C.(CHORDWISE) (FT)	= 0.0	C.G. TO WING A.C.(VERTICAL) (FT)	= 0.0
NOSE TO WING QUARTER-CHORD (FT)	= 10.25500	C.G. TO WING QUARTER-CHORD (FT)	= 0.0
C.G. TO THRUST AXIS (FT)	= 0.0		

LONGITUDINAL STABILITY DERIVATIVES

CL = 0.8104	CLA = 5.3068	CLDA = 2.6067	CLQ = 5.6115	CLDE = 0.7989	CLU = 0.0	CT = 0.0
CD = 0.0596	CDA = 0.3570	CDDA = 0.0	CDQ = 0.0	CDDE = 0.0	CDU = 0.0	CTU = 0.0
CM = 0.0	CMA = -0.4291	CMDA = -8.7804	CMQ =-18.9018	CMDE = -2.6912	CMU = 0.0	CTRPM = 0.0

DENOMINATOR ROOTS

ROOT(1) =	-0.01317	+J	-0.21385
ROOT(2) =	-0.01317	+J	0.21385
ROOT(3) =	-2.86418	+J	-0.72226
ROOT(4) =	-2.86418	+J	0.72226

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
SHORT PERIOD	2.95384	0.72226	0.96965	0.24201	1.04592
PHUGOID	0.21426	0.21385	0.06146	52.63901	227.49962

FIGURE 17

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PERTINENT AIRPLANE CHARACTERISTICS

RHO =	0.001988	WING AREA =	155.000000	MASS =	124.224000	G*COS(GAMMA) =	32.000000
U =	286.0000	CHORD =	4.110000	SPAN =	39.3500	G*SIN(GAMMA) =	0.0
IXX =	5250.0000	IXZ =	0.0	IZZ =	7323.0000	CL =	0.317400
SA =	0.0	DIH =	7.000000	ZW =	1.083300	FUSVOL =	285.680651
H =	4.292000	SV =	19.500000	BV =	5.883000	RI =	0.916700
TR =	0.500000	ZV =	2.667000	ETAV =	0.960000	SBS =	80.909591
LF =	27.400000	LT =	16.000000	XM =	10.000000	HI =	2.833000
H2 =	2.833000	W =	4.330000	SAH =	0.0	CLA2DW =	6.969399
BH =	13.558000	SH =	36.500000	TRH =	1.000000	CLA2DH =	6.589500
BA =	8.600000	CA =	0.662000	SR =	7.600000	ALPHA =	0.003996
CDO =	0.035100	YI =	7.939800	HNOSE =	1.300000	WNOSE =	2.000000
HFCY =	2.833000	WFCY =	4.000000	LFCY =	6.667000	LMH =	10.000000
HBCY =	4.000000	WBCY =	4.250000	LBCY =	13.667000		

LATERAL STABILITY DERIVATIVES

CYB =	-0.479787	CLB =	-0.165963	CNB =	0.124548	CYP = -0.240417	CLP = -0.586804	CNP = -0.041782
CYR =	0.324597	CLR =	0.099626	CNR =	-0.142518	CYDA = 0.0	CLDA = 0.173526	CNDA = -0.014204
CYDR =	0.226060	CLDR =	0.015322	CNDR =	-0.088241			

DENOMINATOR ROOTS

ROOT(1) =	-0.30404	+J	-3.01431
ROOT(2) =	-0.30404	+J	3.01431
ROOT(3) =	-4.02414	+J	0.0
ROOT(4) =	-0.01499	+J	0.0
ROOT(5) =	0.0	+J	0.0

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
DUTCH ROLL	3.0296	3.0143	0.10036	2.27981	9.85307

FIGURE 18

PERTINENT AIRPLANE CHARACTERISTICS

RHO	=	0.001988	WING AREA	=	182.730000	MASS	=	124.224000	G*COS(GAMMA)	=	32.000000
U	=	286.0000	CHORD	=	4.750000	SPAN	=	39.3500	G*SIN(GAMMA)	=	0.0
IXX	=	5250.0000	IXZ	=	0.0	IZZ	=	7323.0000	CL	=	0.317400
SA	=	0.0	DIH	=	7.000000	ZW	=	1.083300	FUSVOL	=	285.680651
H	=	4.292000	SV	=	19.500000	BV	=	5.883000	RI	=	0.916700
TR	=	0.500000	ZV	=	2.667000	ETAV	=	0.960000	SBS	=	80.909591
LF	=	27.400000	LT	=	16.000000	XM	=	10.000000	HI	=	2.833000
H2	=	2.833000	W	=	4.330000	SAH	=	0.0	CLA2DW	=	6.969399
BH	=	13.558000	SH	=	36.500000	TRH	=	1.000000	CLA2DH	=	6.589500
BA	=	8.600000	CA	=	0.662000	SR	=	7.600000	ALPHA	=	0.003996
CDO	=	0.035100	YI	=	7.939800	HNOSE	=	1.300000	WNOSE	=	2.000000
HFCY	=	2.833000	WFCY	=	4.000000	LFCY	=	6.667000	LMH	=	10.000000
HBCY	=	4.000000	WBCY	=	4.250000	LBCY	=	13.667000			

LATERAL STABILITY DERIVATIVES

CYB	=	-0.399758	CLB	=	-0.163115	CNB	=	0.100244	CYP	=	-0.223734
CYR	=	0.263831	CLR	=	0.094446	CNR	=	-0.117575	CYDA	=	0.0
CYDR	=	0.191755	CLDR	=	0.012996	CNDR	=	-0.074850			

CLP	=	-0.536032	CNP	=	-0.036939						
CLDA	=	0.153825	CNDA	=	-0.012239						

DENOMINATOR ROOTS

ROOT(1)	=	-0.28228	+J	-2.96730
ROOT(2)	=	-0.28228	+J	2.96730
ROOT(3)	=	-4.33740	+J	0.0
ROOT(4)	=	-0.01724	+J	0.0
ROOT(5)	=	0.0	+J	0.0

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
DUTCH ROLL	2.9807	2.9673	0.09470	2.45549	10.61234

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FIGURE 19

PERTINENT AIRPLANE CHARACTERISTICS

RHO = 0.002378	WING AREA =	155.000000	MASS =	124.224000	G*COS(GAMMA) =	32.038000
U = 161.0000	CHORD =	4.110000	SPAN =	39.3500	G*SIN(GAMMA) =	3.220000
IXX = 5250.0000	IXZ =	0.0	IZZ =	7323.0000	CL =	0.834200
SA = 0.0	DIH =	7.000000	ZW =	1.083300	FUSVOL =	295.680651
H = 4.292000	SV =	19.500000	BV =	5.883000	R1 =	0.916700
TR = 0.500000	ZV =	2.667000	ETAV =	0.960000	SBS =	80.909591
LF = 27.400000	LT =	16.000000	XM =	10.000000	H1 =	2.833000
H2 = 2.833000	W =	4.330000	SAH =	0.0	CLA2DW =	6.650238
BH = 13.558000	SH =	36.500000	TRH =	1.000000	CLA2DH =	6.589500
BA = 8.600000	CA =	0.662000	SR =	7.600000	ALPHA =	0.097747
CDO = 0.035100	YI =	7.939800	HNOSE =	1.300000	WNOSE =	2.000000
HFCY = 2.833000	WFCY =	4.000000	LFCY =	6.667000	LMH =	10.000000
HBCY = 4.000000	WBCY =	4.250000	LBCY =	13.667000		

LATERAL STABILITY DERIVATIVES

CYB = -0.479767	CLB = -0.223541	CNB = 0.130041	CYP = -0.312663	CLP = -0.570755	CNP = -0.090307
CYR = 0.398499	CLR = 0.225509	CNR = -0.136648	CYDA = 0.0	CLDA = 0.178526	CNDA = -0.037332
CYDR = 0.226060	CLDR = 0.015322	CNDR = -0.088241			

DENOMINATOR ROOTS

ROOT(1) =	-0.11234	+J	-2.07583
ROOT(2) =	-0.11234	+J	2.07583
ROOT(3) =	-2.83109	+J	0.0
ROOT(4) =	0.01510	+J	0.0
ROOT(5) =	0.0	+J	0.0

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
DUTCH ROLL	2.0789	2.0758	0.05404	6.17008	26.66638

FIGURE 20

PERTINENT AIRPLANE CHARACTERISTICS

RHO = 0.002378	WING AREA = 182.730000	MASS = 124.224000	G*COS(GAMMA) = 32.038000
U = 161.0000	CHORD = 4.750000	SPAN = 39.3500	G*SIN(GAMMA) = 3.220000
IXX = 5250.0000	IXZ = 0.0	IZZ = 7323.0000	CL = 0.834200
SA = 0.0	DIH = 7.000000	ZW = 1.083300	FUSVOL = 285.680651
H = 4.292000	SV = 19.500000	BV = 5.883000	R1 = 0.916700
TR = 0.500000	ZV = 2.667000	ETAV = 0.960000	SBS = 90.909591
LF = 27.400000	LT = 16.000000	XM = 10.000000	H1 = 2.833000
H2 = 2.833000	W = 4.330000	SAH = 0.0	CLA2DW = 6.650238
BH = 13.558000	SH = 36.500000	TRH = 1.000000	CLA2DH = 6.589500
BA = 8.600000	CA = 0.662000	SR = 7.600000	ALPHA = 0.097747
COO = 0.035100	YI = 7.939800	HNOSE = 1.300000	WNOSE = 2.000000
HFCY = 2.833000	WFCY = 4.000000	LFCY = 6.667000	LMH = 10.000000
HBCY = 4.000000	WBCY = 4.250000	LBCY = 13.667000	

LATERAL STABILITY DERIVATIVES

CYB = -0.399758	CLB = -0.235619	CNB = 0.104904	CYP = -0.296921	CLP = -0.522844	CNP = -0.080538
CYR = 0.337733	CLR = 0.218601	CNR = -0.110318	CYDA = 0.0	CLDA = 0.153825	CNDA = -0.032167
CYDR = 0.191755	CLDR = 0.012996	CNDR = -0.074850			

DENOMINATOR ROOTS

ROOT(1) =	-0.07526	+J	-2.09412
ROOT(2) =	-0.07526	+J	2.09412
ROOT(3) =	-3.07710	+J	0.0
ROOT(4) =	0.01002	+J	0.0
ROOT(5) =	0.0	+J	0.0

	NATURAL FREQ UNDAMPED	NATURAL FREQ DAMPED	DAMPING RATIO	TIME FOR 1/2 DAMPING	SETTLING TIME
DUTCH ROLL	2.0955	2.0941	0.03592	9.21014	39.80514

FIGURE 21

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MEASURING DRAG AND THRUST IN FLIGHT

The Concept

Most techniques for the determination of aircraft drag in flight rely on the fact that when the aircraft is in unaccelerated flight, the forces along its x-axis, principally the thrust and drag, are in balance. Then, if one knows the propulsive thrust for a particular flight condition, he automatically knows the aircraft drag at that condition. Thus, to apply these techniques one must know that $\dot{V} = 0$ as well as the propulsive thrust as a function of flight speed, altitude, and power setting.

This, unfortunately, is not determined easily. Although engine output can be measured accurately on a test stand as a function of altitude and power setting and propeller characteristics can be determined in a test cell as a function of RPM and flight velocity, the flow disturbances caused by putting a cowled engine behind a propeller and mounting the whole on an airplane are not readily determined *a priori*. Hence, efforts have been made from time to time to measure inflight thrust using such techniques as the torque reaction produced by the engine or the vehicle acceleration at constant altitude produced by varying power levels.

The reader will readily appreciate the difficulties which such techniques entail. In the case of the ATLIT aircraft, instrumentation to measure reaction torques was not available and the longitudinal accelerometer provided in the instrument package was not considered a primary test instrument, at least initially. Further, the establishment of really unaccelerated flight at many different speeds is very consuming of flight test time. It is for these reasons that an effort was made to develop an alternate technique to measure thrust and drag simultaneously in accelerated flight.

The origin of the concept is quite simple. Recent workers attempting to extract the values of stability derivatives from flight data have all faced the problem of fitting an analytical model containing thirteen or more undetermined coefficients to a set of four or five simultaneous time histories. That is, the number of unknowns greatly exceeds the number of independent equations one can write to describe the motion. The problem is usually attacked (see Ref. 6 for example) by fitting the equations to the time histories at a number of different times. Theoretically, one need only fit the equation the same number of times as one desires to find coefficient values. In practice, it is fit many, many times and the values which best satisfy the time history in some statistical sense are chosen. If the initial estimates of the parameter values are reasonably accurate, the procedure usually converges on the correct values. However, since the system is not determinant, convergence is not guaranteed.

The problem in determining both drag and thrust simultaneously in flight is that there is one more unknown than there is equation. Mathematically

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this means that for any flight condition there are an infinite number of sets of T and D which satisfy the equation. For any T there is only one D, but one can find the corresponding D for any arbitrary choice of T whether it has any physical meaning or not.

Following the fairly successful approach used in stability derivative extraction, it was reasoned that if one would write the equation of motion substituting flight data for different times in the flight, he could create a system of equations equal to the number of unknowns. Formally, the equation of motion of the vehicle along its trajectory in the X-Z terrestrial plane is

$$\frac{\dot{V}}{g} + \sin \gamma = \frac{T - D}{W} . \tag{3}$$

In order to apply the technique, we wish to express the thrust and drag in a polynomial expansion of some easily-measured flight variable with the coefficients to be undetermined constants. Now, the thrust is known to depend primarily upon flight speed for a given power setting so that we choose the representation

$$T = \frac{\cos \alpha}{V} \left[P_0 + P_1 V + P_2 V^2 \right] . \tag{4}$$

In other words, we assume that the power-speed relationship is a parabola. Given the characteristics of most propellers, P_0 and P_1 will be positive and P_2 negative. We insert the cos α term because we assume that the propeller thrust is always applied along the x-body axis rather than along the flight path. Drag, on the other hand, is always defined with respect to the flight path. We can represent the drag by the equation

$$D = 1/2 \, \rho S V^2 \left[C_{D_0} + C_{D_1} \alpha^2 + C_{D_2} \alpha^6 \right] , \tag{5}$$

where α is measured from zero lift and the sixth power for the third term was chosen on the basis of curve fits to some actual data. Note, however, that we may alter the model to represent a particular situation more accurately without affecting the validity of the procedure.

Substituting these relationships into the equation of motion yields

$$\frac{W\dot{V}}{g} + W \sin \gamma = \frac{\cos \alpha}{V} \left[P_0 + P_1 V + P_2 V^2 \right] - \frac{1}{2} \rho S V^2 \left[C_{D_0} + C_{D_1} \alpha^2 + C_{D_2} \alpha^6 \right] . \tag{6}$$

This equation has six unknown but constant coefficients. By determining the flight values of γ, W, V, $\dot{V}$, ρ, and α at six different times we create a system of six linear equations in six unknowns. This can then be solved for the values of P_0, P_1, P_2, C_{D_0}, C_{D_1}, and C_{D_2}.

Difficulties in Concept Execution

Unfortunately, this system of equations is what mathematicians call ill-conditioned; that is, very small changes in any of the measured values (α, W, V, $\dot{V}$, γ, ρ) can cause the coefficient values (P_0, P_1, etc.) to change radically. Further, the solution guarantees to pass through the six selected points only. For any other speed, acceleration, angle of attack, weight, flight path angle, or altitude, the thrust or drag computed with these six coefficients may be quite wrong. In addition, the coefficient values themselves may be ridiculous (for example, a negative C_{D_1} value), yet the total drag as determined from $C_{D_0} + C_{D_1} \alpha^2 + C_{D_2} \alpha^6$ may be very reasonable.

These problems are to some extent traceable to the adequacy of the analytical model used. A model which does not well represent what actually occurs will, when fit to the data using this procedure, produce nonsense numbers for some of the coefficients, i.e., nonsense numbers in the physical sense but absolutely correct numbers in the mathematical sense. For example, if the speed-power relation should in fact be a constant, then an attempt to fit it with a parabola will usually yield non-zero values for P_1 and P_2. While for the speeds, etc. at which the data are submitted to the solution routine the sum of the three terms will be correct, individually the values make little physical sense. Thus, a successful solution routine must have a provision for examining the results (at least manually) for reasonableness and for changing the analytical model if the results are not reasonable.

There is also a problem concerned with the selection of the six data sets submitted to the solution routine. The reader will recognize that if one selects six points very close together in speed, the data must be extremely accurate because all significance can be lost in taking the differences between adjacent numbers as one does in solving a system of six equations.

Amelioration of Solution Difficulties

One means of selecting the six points to be submitted to the solution routine so that it will yield reasonable results is to select those points where the velocities are given by

$$V_1 = V_{min} \text{ for the maneuver}$$

$$V_2 = V_{max} \text{ for the maneuver}$$

$$V_3 = V_1 \left[\frac{V_2}{V_1}\right]^{1/5} \qquad (7)$$

$$V_4 = V_3 \left[\frac{V_2}{V_1}\right]^{1/5}$$

$$V_5 = V_4 \left[\frac{V_2}{V_1}\right]^{1/5}$$

$$V_6 = V_5 \left[\frac{V_2}{V_1}\right]^{1/5} .$$

This procedure spaces the points over all the available data giving emphasis to the portion of the drag curve when changes with speed are most rapid. Where applied to theoretically-generated data, the original coefficients can be recovered to within 1%.

For a variety of reasons, flight measurements will never be as accurate or as noise-free as theoretically-generated data. One then asks the question, "How can I use the remainder of the data (the sets of α, ρ, γ, V, $\dot{V}$, W beyond the six sets mentioned above) taken during a 30-second maneuver to improve the accuracy of the coefficient extraction procedure?" The classical answer is to fit the assumed form of the curve (equation 6) to the data by a least-squares technique. What this does is to determine those values of the coefficients (P_0, P_1, P_2, C_{D_0}, C_{D_1}, C_{D_2}) which make the sum of the squares of the distances from the curve to each of the data points a minimum. The procedure is the following:

Let S be defined by the equation

$$S = \sum_{i=1}^{N} \left[\frac{W_i \dot{V}_i}{g} + W_i \sin(\theta_i - \alpha_i) - \frac{\cos \alpha_i}{V_i} P_0 - \cos \alpha_i \, P_1 \right.$$

$$\left. - V_i \cos \alpha_i \, P_2 + \frac{\rho_i S V_i^2}{2} C_{D_0} + \frac{\rho_i S V_i^2}{2} \alpha_i^2 \, C_{D_1} + \frac{\rho_i S V_i^2}{2} \alpha_i^6 \, C_{D_2} \right]^2 , \quad (8)$$

where the subscript i refers to the value of the variable at the ith time. This equation is a measure of the precision with which the theoretical model with six unknown constants (P_0, P_1, P_2, C_{D_0}, C_{D_1}, C_{D_2}) satisfies the experimental data. The closer S is to zero, the better the fit. We wish to minimize the error with respect to all six unknowns. Thus, we set

$$\frac{\partial S}{\partial P_0} = 0 = -2 \sum_{i=1}^{N} \left[\frac{\cos \alpha}{V_i} \right] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right]$$

$$\frac{\partial S}{\partial P_1} = 0 = -2 \sum_{i=1}^{N} [a_3] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right]$$

$$\frac{\partial S}{\partial P_2} = 0 = -2 \sum_{i=1}^{N} [a_4] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right]$$

$$\frac{\partial S}{\partial C_{D_0}} = 0 = 2 \sum_{i=1}^{N} [a_5] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right]$$

$$\frac{\partial S}{\partial C_{D_1}} = 0 = 2 \sum_{i=1}^{N} [a_6] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right]$$

$$\frac{\partial S}{\partial C_{D_2}} = 0 = 2 \sum_{i=1}^{N} [a_7] \left[a_1 - a_2 P_0 - a_3 P_1 - a_4 P_2 + a_5 C_{D_0} + a_6 C_{D_1} + a_7 C_{D_2} \right] \quad (9)$$

where

$$a_1 = \frac{W_i \dot{V}_i}{g} + W_i \sin(\theta_i - \alpha_i) \qquad a_2 = \frac{\cos \alpha_i}{V_i}$$

$$a_3 = \cos \alpha_i \qquad a_6 = \frac{\rho_i S V_i^2}{2} \alpha_i^2$$

$$a_4 = V_i \cos \alpha_i \qquad a_7 = \frac{\rho_i S V_i^2}{2} \alpha_i^6 \, .$$

$$a_5 = \frac{\rho_i S V_i^2}{2}$$

In expanded form these equations may be written

$$\sum_{i=1}^{N} \frac{\cos \alpha_i}{V_i} \left[\frac{W_i \dot{V}_i}{g} + W_i \sin(\theta_i - \alpha_i) \right] = \sum_{i=1}^{N} \frac{\cos^2 \alpha_i}{V_i^2} P_0 + \sum_{i=1}^{N} \frac{\cos^2 \alpha_i}{V_i} P_1$$

$$+ \sum_{i=1}^{N} \cos^2 \alpha_i \, P_2 - \sum_{i=1}^{N} \frac{\rho_i S V_i^2}{2} \cos \alpha_i \, C_{D_0}$$

$$- \sum_{i=1}^{N} \frac{\rho_i S V_i^2}{2} \alpha_i^2 \cos \alpha_i \, C_{D_1} + \sum_{i=1}^{N} \frac{\rho_i S V_i^2}{2} \alpha_i^6 \cos \alpha_i \, C_{D_2} \, . \qquad (10)$$

•
•
•
•
•
•

The term $\sum_{i=1}^{N} \frac{\cos^2 \alpha_i}{V_i^2}$ multiplying P_0 represents a sum of terms $\frac{\cos^2 \alpha}{V}$, for each of the N data points in the set. Once this and the similar sums are formed, one has simply a system of six first order algebraic equations in six unknowns which can be solved with some labor for the values of the six unknown coefficients. These coefficient values provide the "best" fit, using the model

chosen, to the set encompassing all the data points. The coefficient values may change, of course, if data are added to or deleted from the set. Needless to say, the coefficient values may be in error if the data contains spurious signals or if the model chosen does not represent the physical situation adequately. Also if the data points are not well-distributed over the entire speed range, the coefficients which are the principal contributors to the function value in an underrepresented speed region may be in error. As a result of these factors it is necessary to approach the extraction process with some care.

Despite these difficulties, the following example is illustrative of what can be done using this method. Figure 22 shows the assumed drag variation with angle of attack and figure 23 the assumed power variation with speed. These data were then inserted in the NCSU path performance program described in Ref. 2 to obtain time histories of ρ, α, V, W, $\dot{V}$, and γ. These and related time histories are shown in figure 24. The path performance program is a forward integration scheme which varies the integration step size according to an error criterion. Thus the time histories will all contain very small errors which cause the time histories to differ very slightly from the true values of the functions at any particular time. One cannot, therefore, expect to recover the exact values of the drag and power expressions by proceeding in this fashion. The values of the time histories shown in figure 24 at each 0.1 seconds were then submitted to the least squares routine. The coefficients developed by the program match the first six significant digits of the coefficients in the power and drag functions which were used to generate the time histories. The recovered coefficients, when inserted in the equation with the values of the parameters from PATH at each of almost 300 points, satisfy the equation to within 10^{-19} or better for the sum of all points.

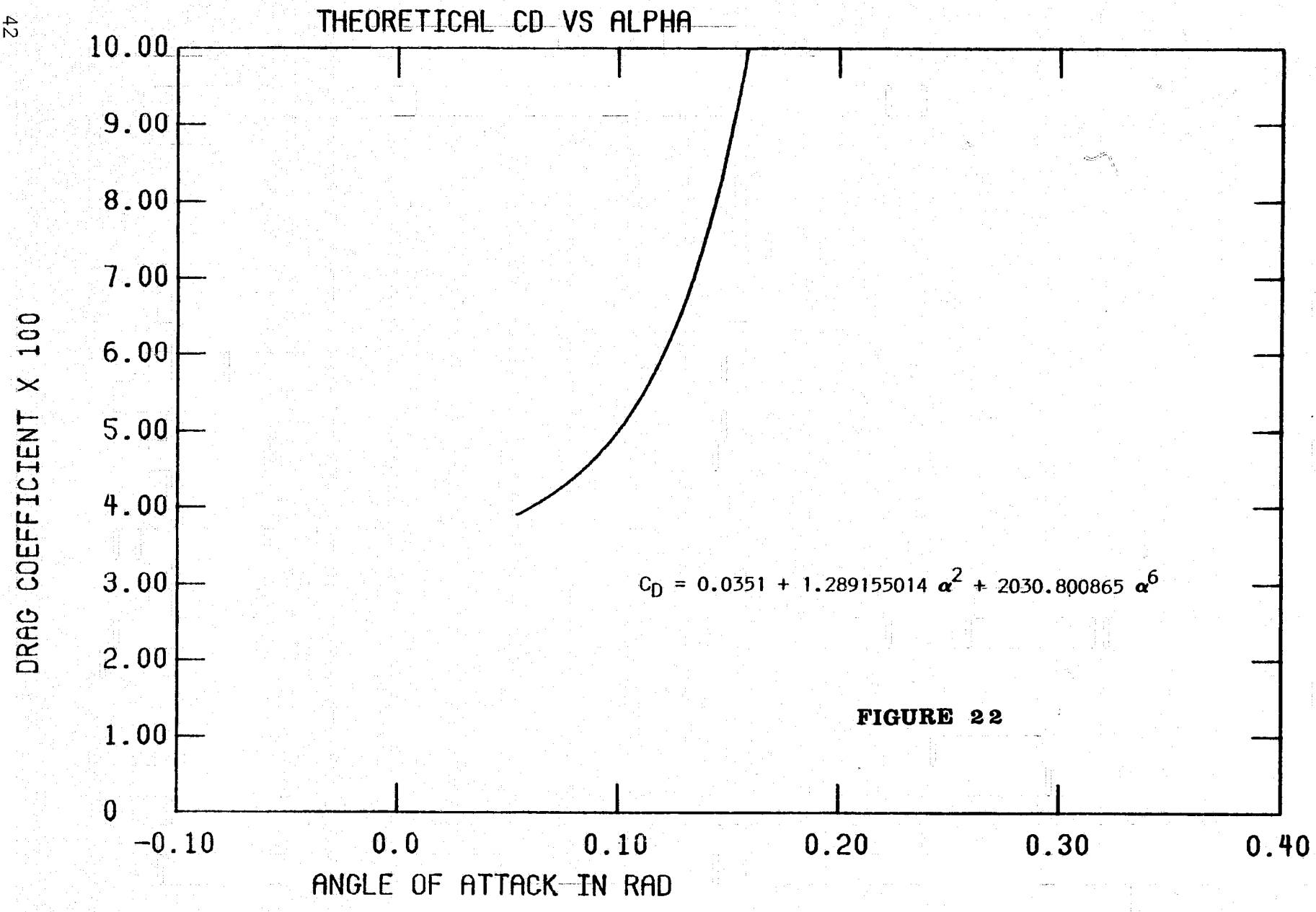

THEORETICAL CD VS ALPHA
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0
DRAG COEFFICIENT X 100
$C_D = 0.0351 + 1.289155014\ \alpha^2 + 2030.800865\ \alpha^6$
-0.10
0.0
0.10
0.20
0.30
0.40
ANGLE OF ATTACK IN RAD

FIGURE 22

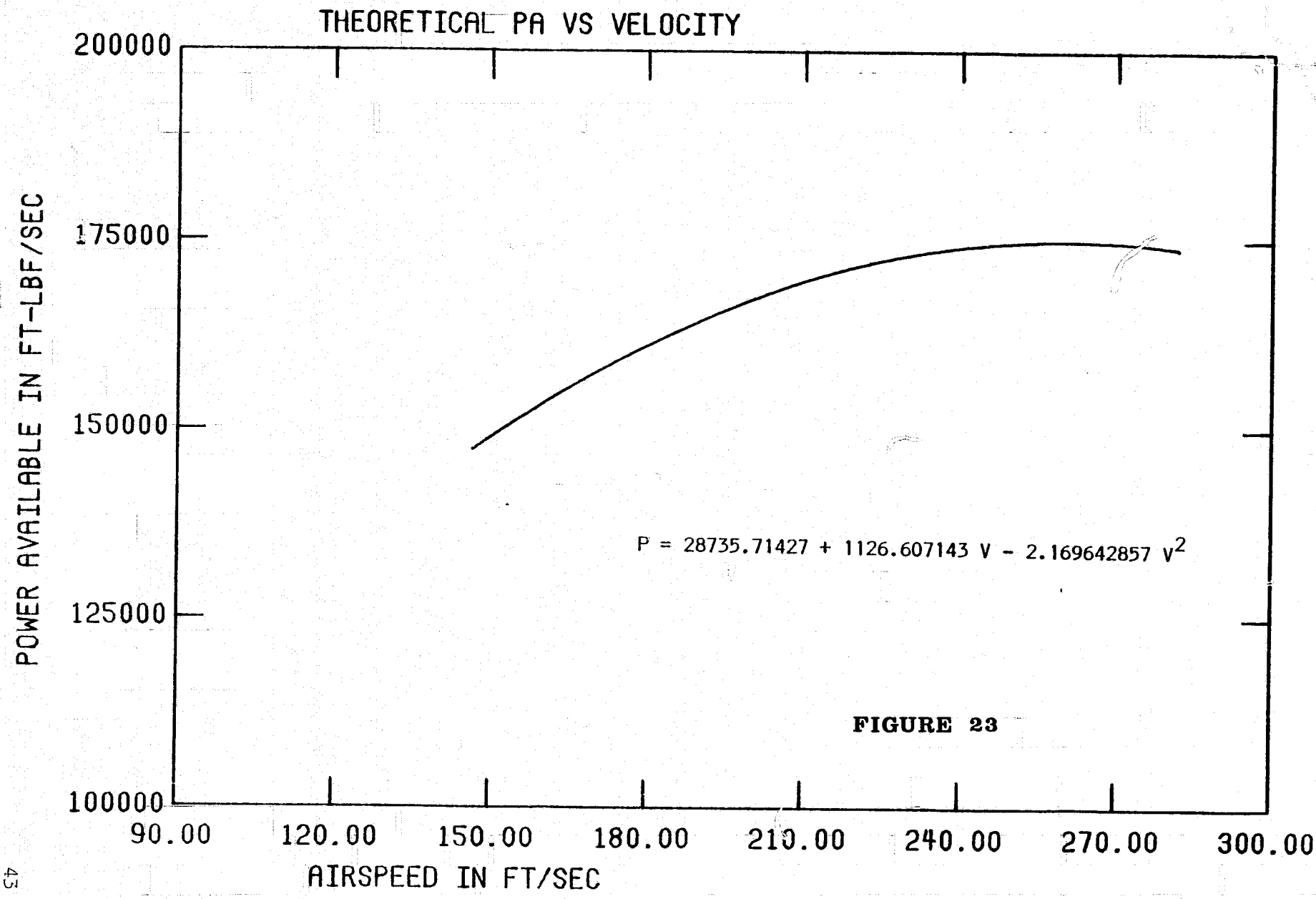

THEORETICAL PA VS VELOCITY
200000
175000
150000
125000
100000
POWER AVAILABLE IN FT-LBF/SEC
P = 28735.71427 + 1126.607143 V - 2.169642857 V2
90.00
120.00
150.00
180.00
210.00
240.00
270.00
300.00
AIRSPEED IN FT/SEC

FIGURE 23

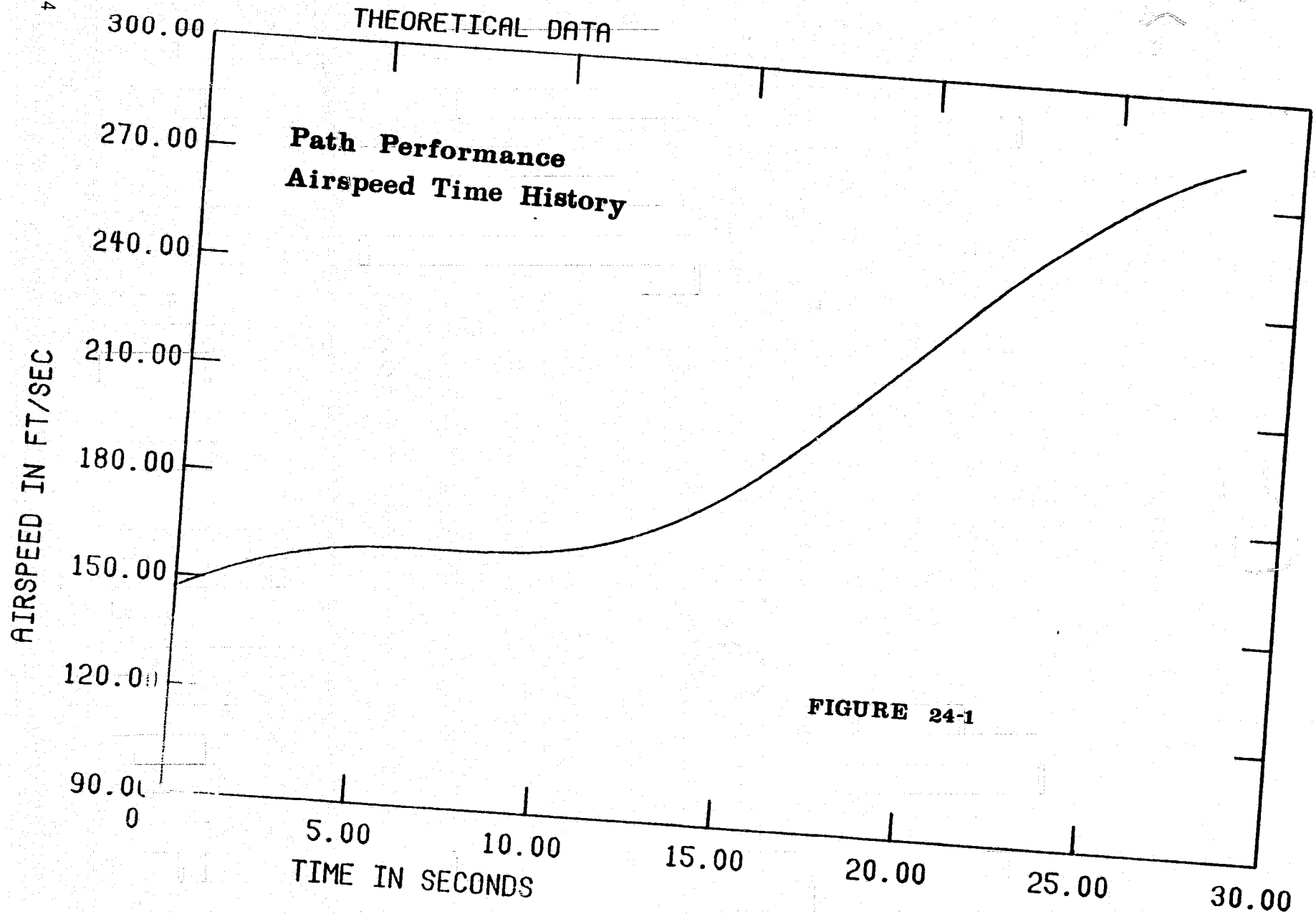

THEORETICAL DATA
Path Performance
Airspeed Time History
AIRSPEED IN FT/SEC
300.00
270.00
240.00
210.00
180.00
150.00
120.00
90.00
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-1

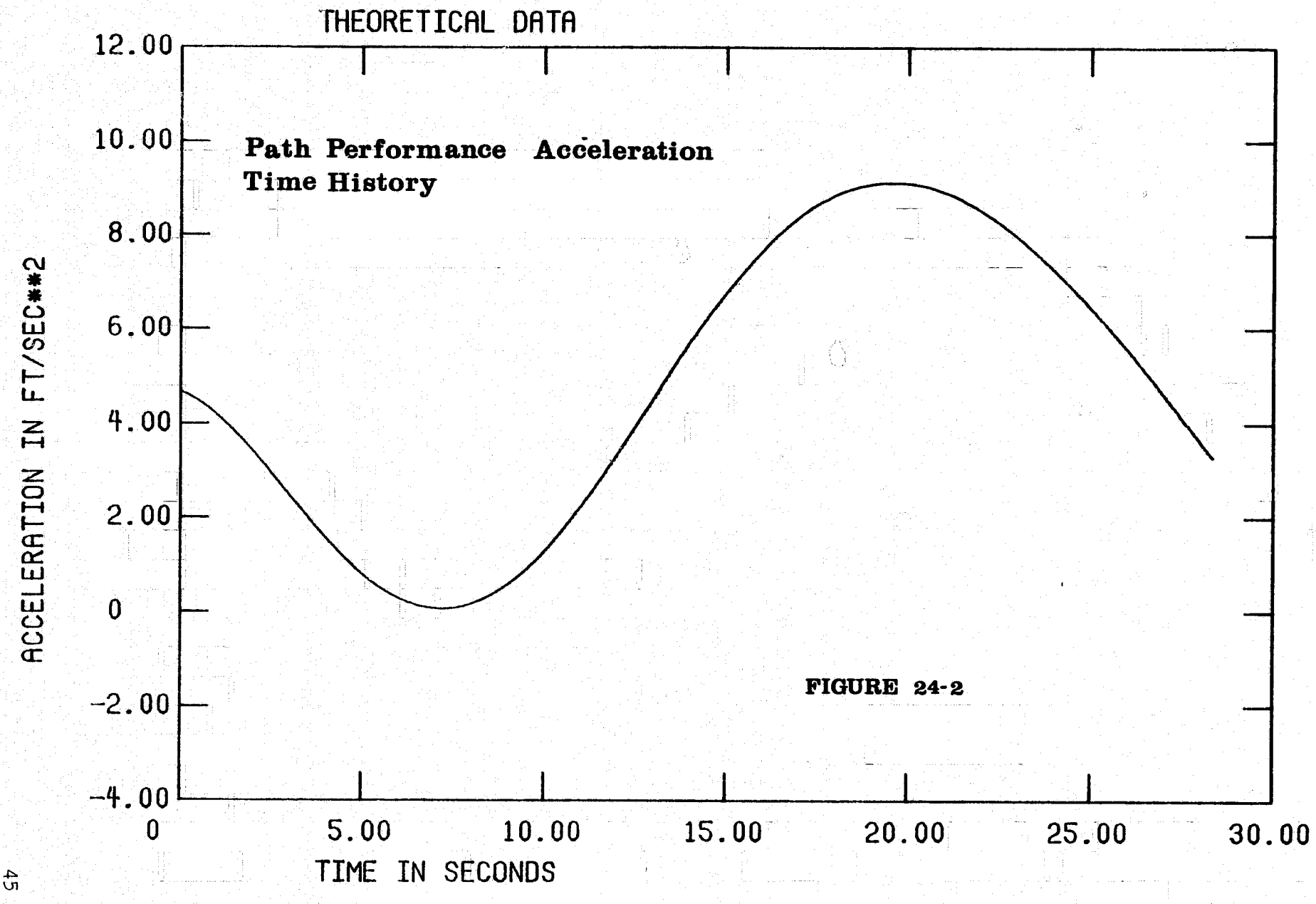

THEORETICAL DATA
Path Performance Acceleration
Time History
ACCELERATION IN FT/SEC**2
12.00
10.00
8.00
6.00
4.00
2.00
0
-2.00
-4.00
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-2

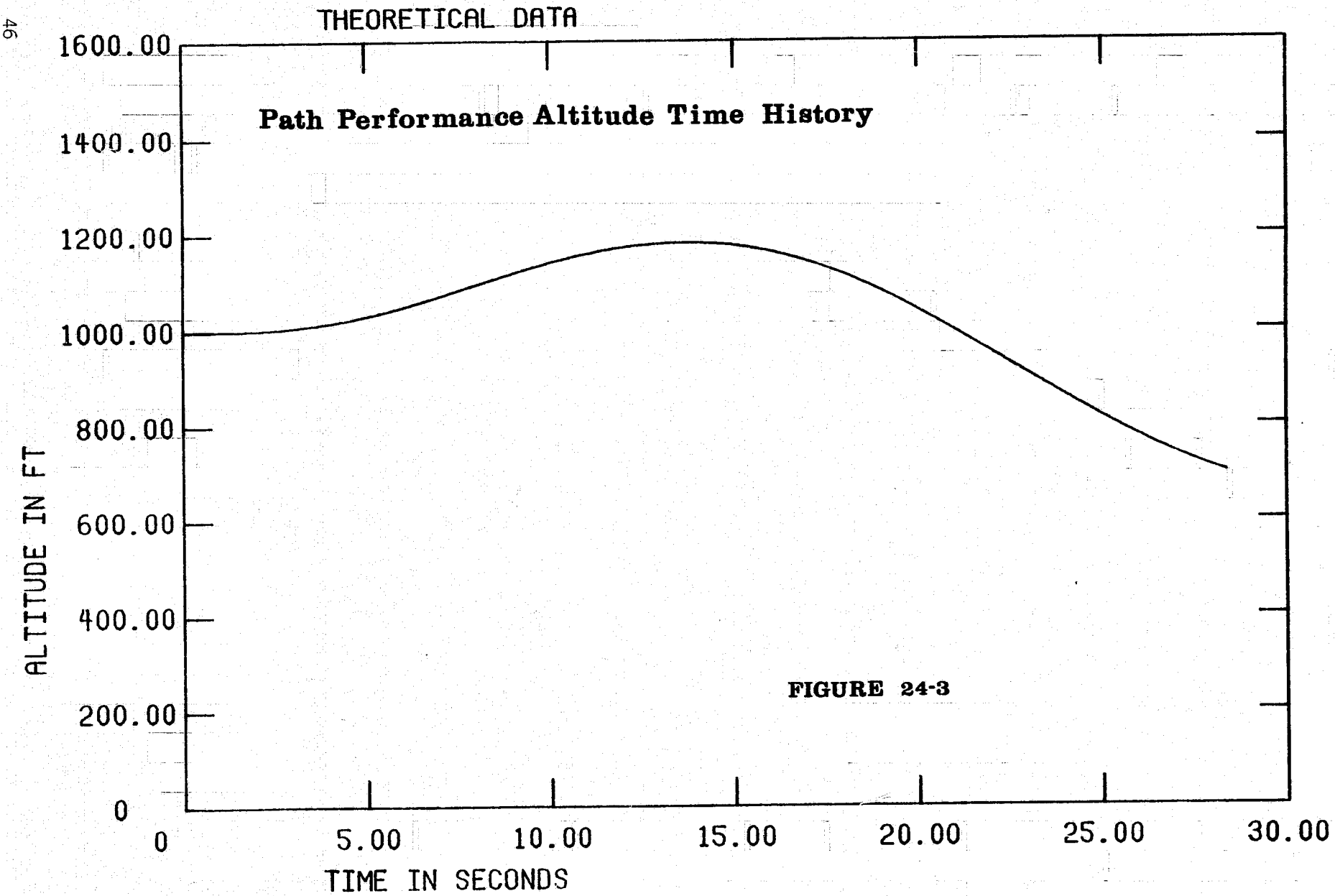

THEORETICAL DATA
Path Performance Altitude Time History
1600.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0
ALTITUDE IN FT
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-3

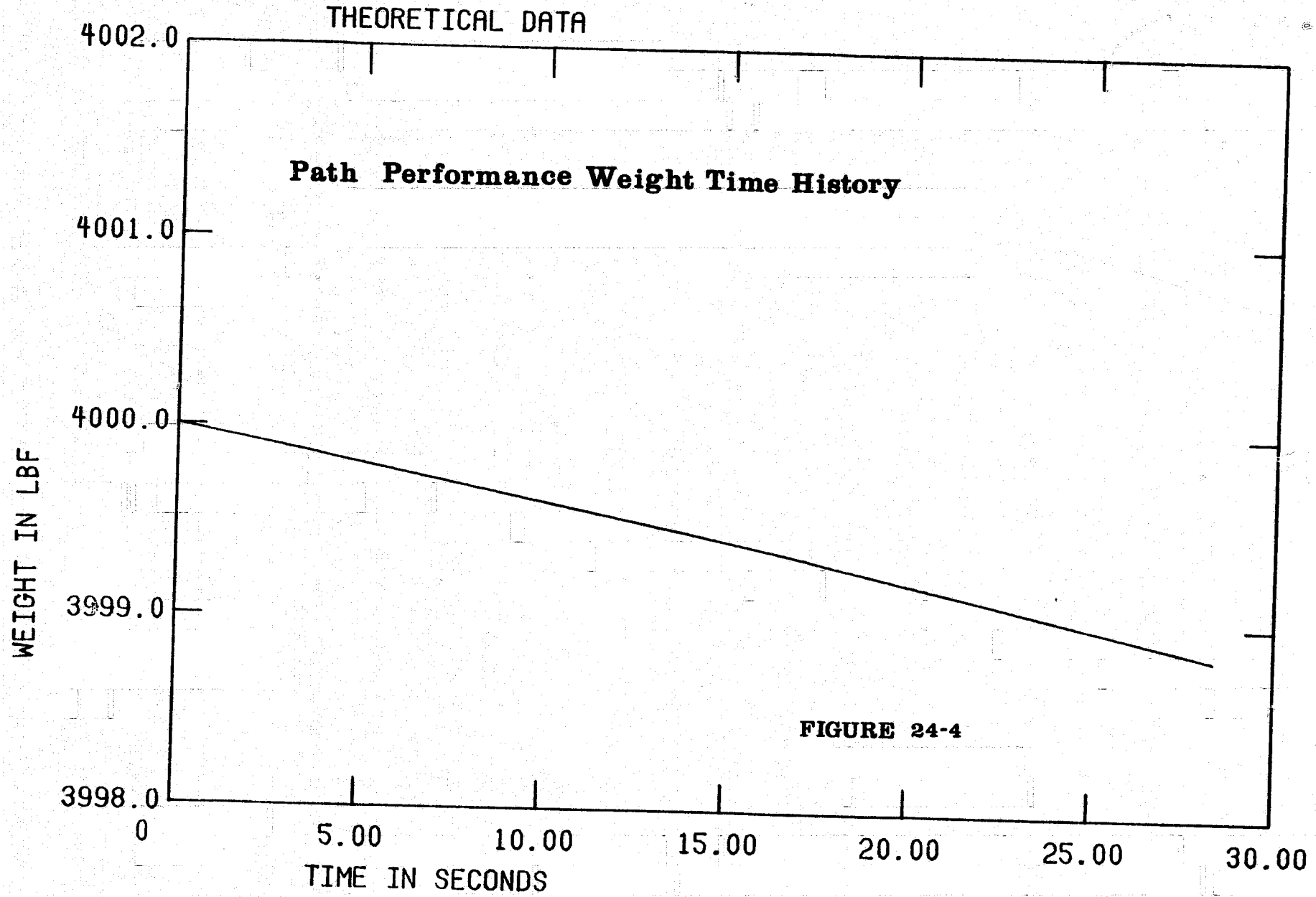

THEORETICAL DATA
Path Performance Weight Time History
4002.0
4001.0
4000.0
3999.0
3998.0
WEIGHT IN LBF
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-4

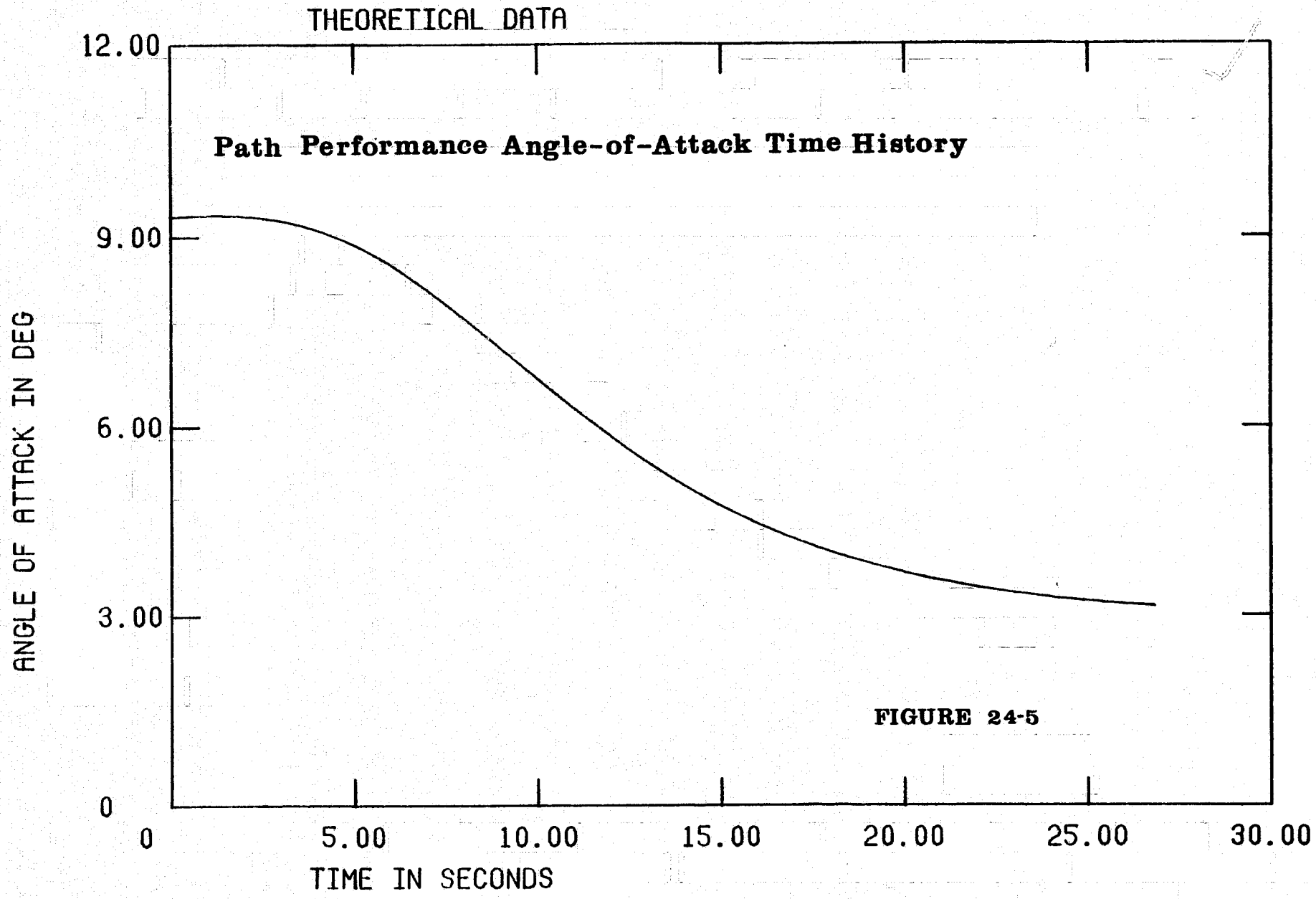

THEORETICAL DATA
Path Performance Angle-of-Attack Time History
ANGLE OF ATTACK IN DEG
12.00
9.00
6.00
3.00
0
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-5

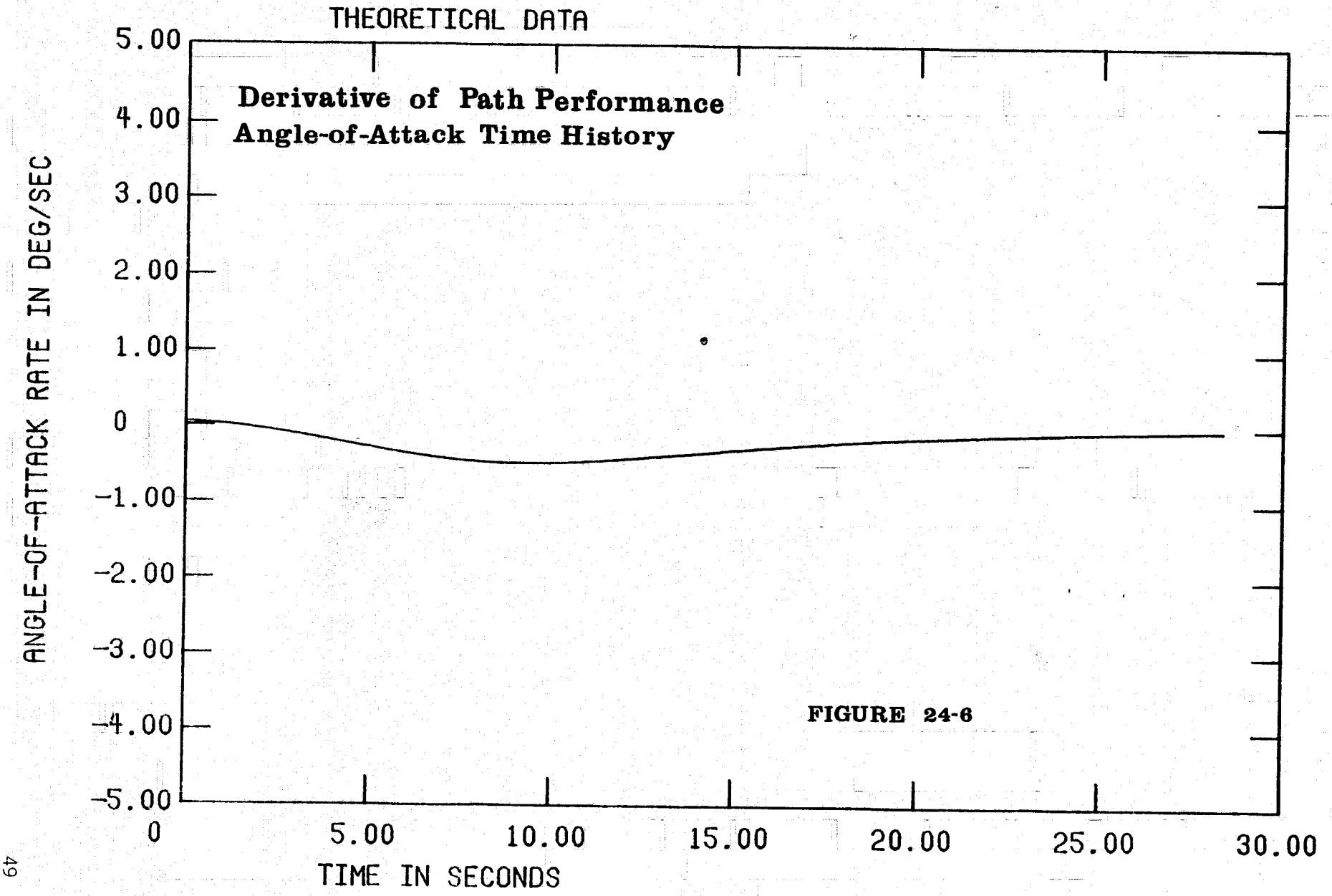

THEORETICAL DATA
Derivative of Path Performance
Angle-of-Attack Time History
ANGLE-OF-ATTACK RATE IN DEG/SEC
5.00
4.00
3.00
2.00
1.00
0
-1.00
-2.00
-3.00
-4.00
-5.00
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-6

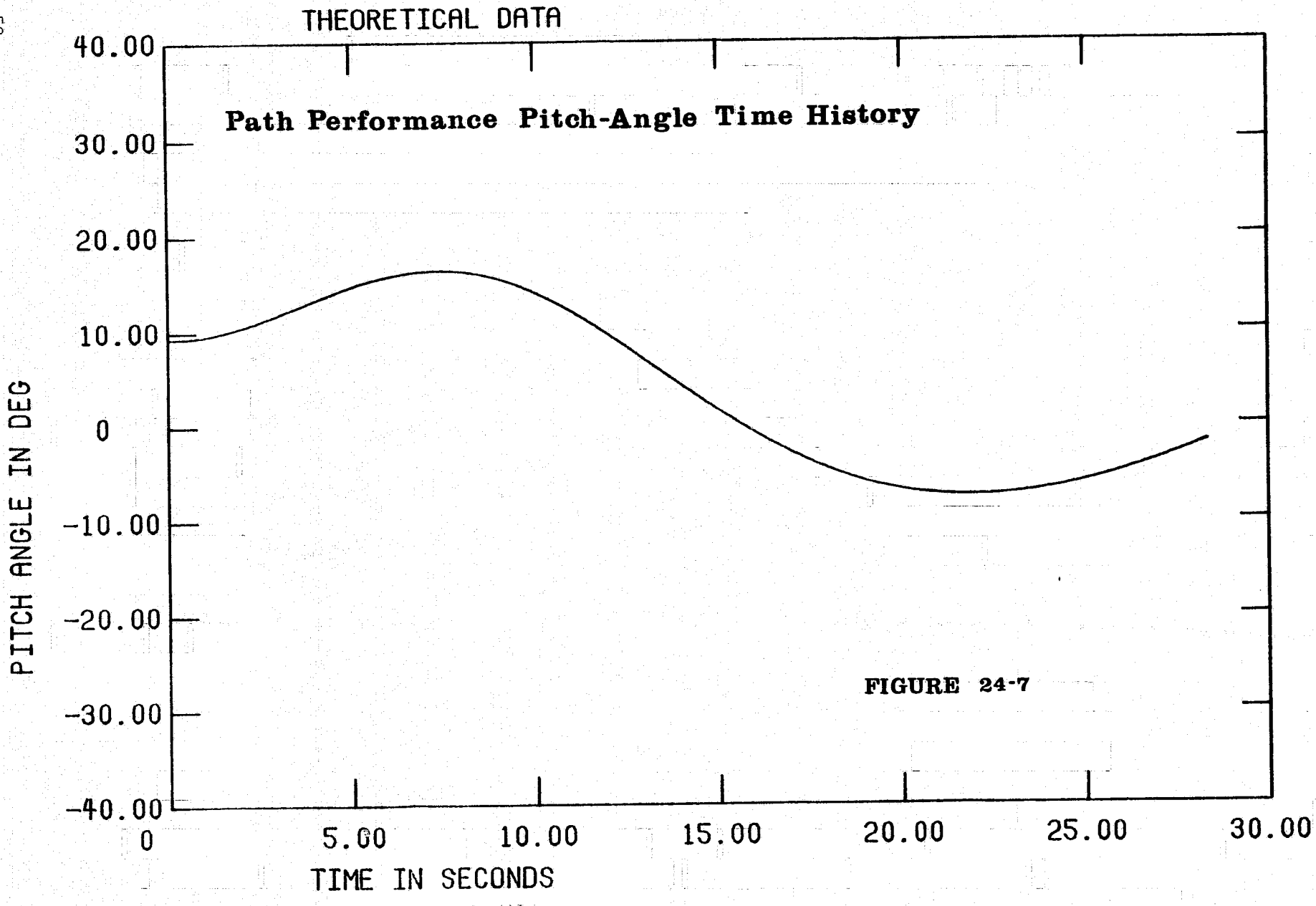

THEORETICAL DATA
Path Performance Pitch-Angle Time History
40.00
30.00
20.00
10.00
0
-10.00
-20.00
-30.00
-40.00
PITCH ANGLE IN DEG
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-7

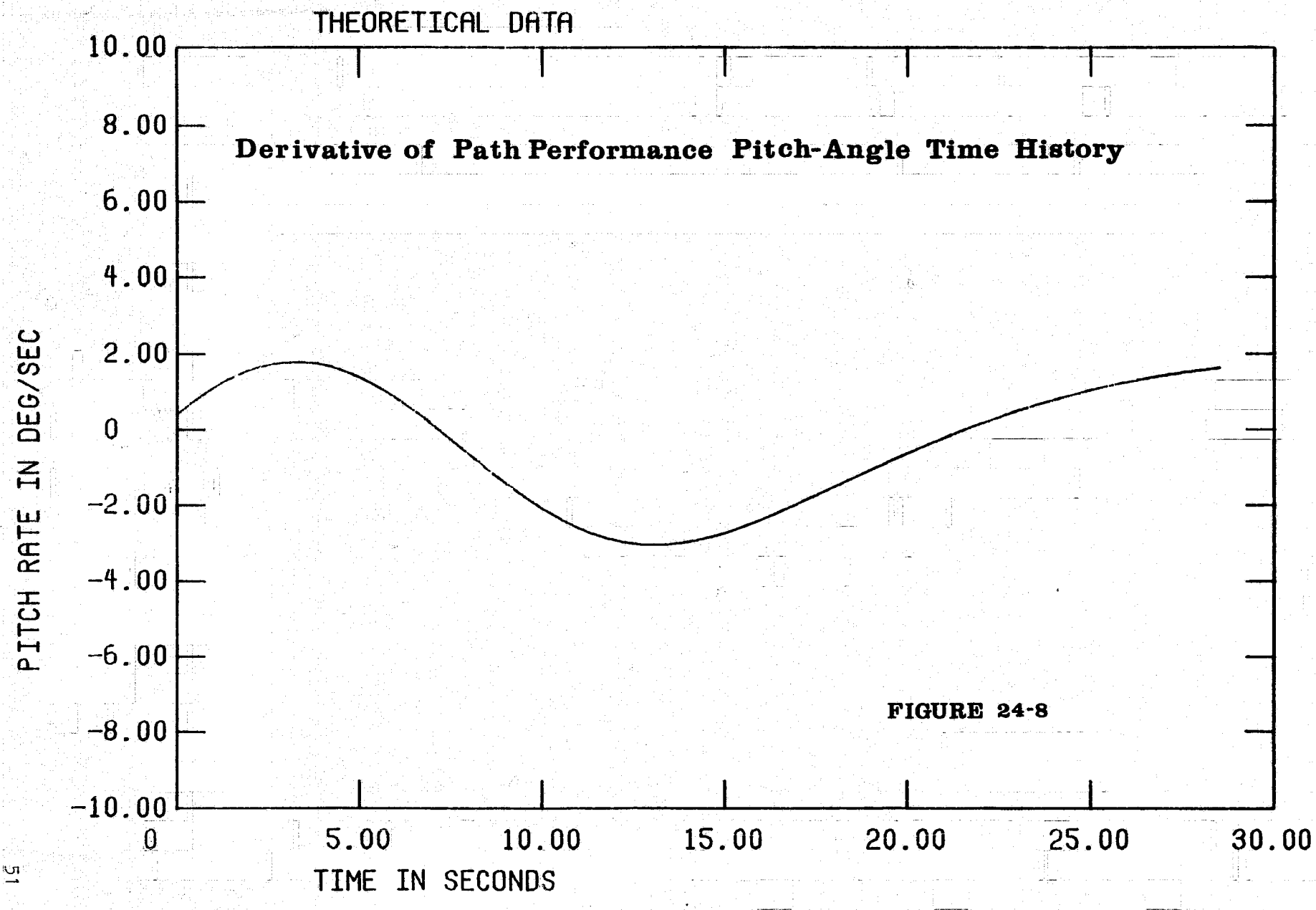

THEORETICAL DATA
Derivative of Path Performance Pitch-Angle Time History
PITCH RATE IN DEG/SEC
10.00
8.00
6.00
4.00
2.00
0
-2.00
-4.00
-6.00
-8.00
-10.00
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-8

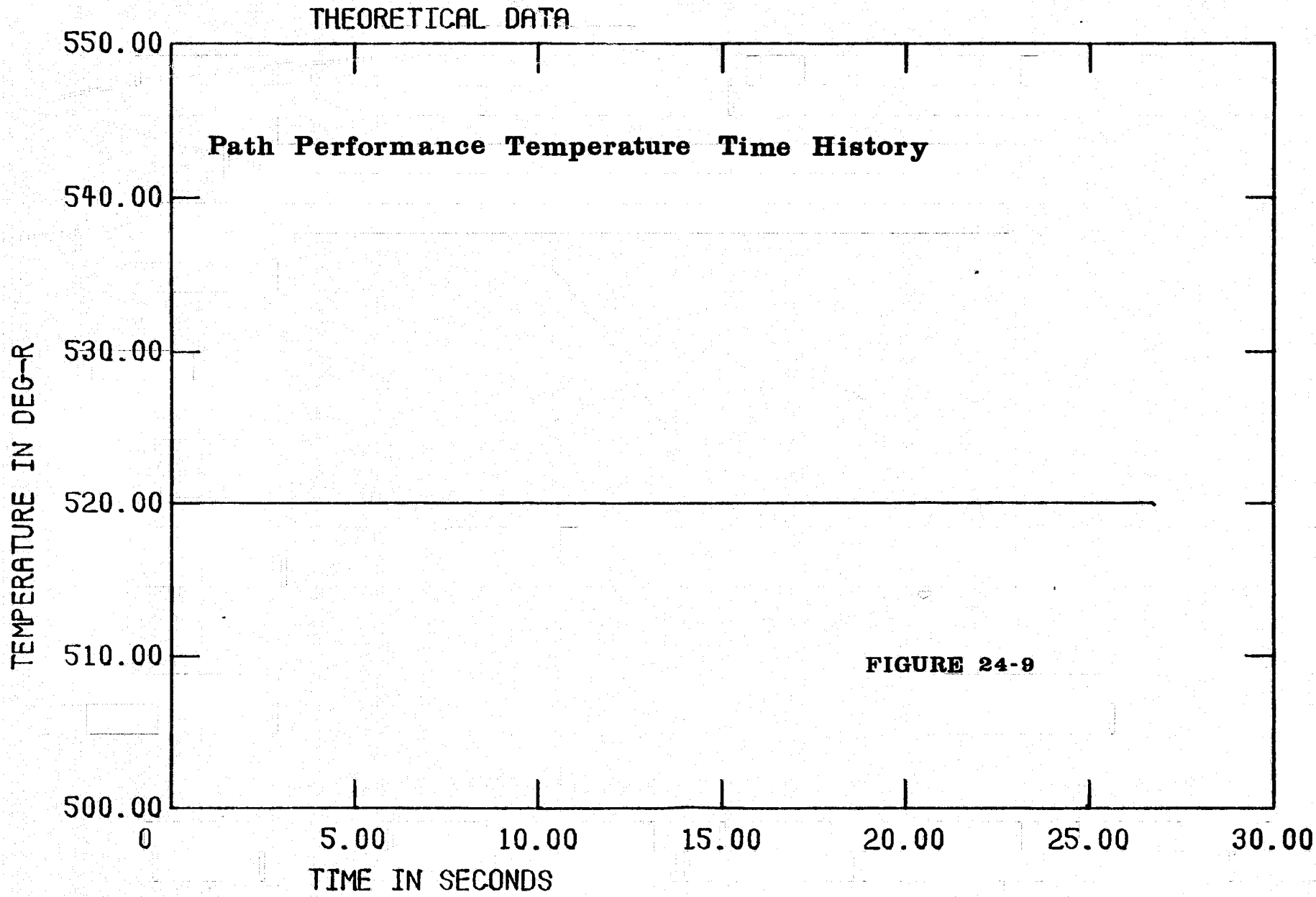

THEORETICAL DATA
Path Performance Temperature Time History
550.00
540.00
530.00
520.00
510.00
500.00
TEMPERATURE IN DEG-R
0
5.00
10.00
15.00
20.00
25.00
30.00
TIME IN SECONDS

FIGURE 24-9

Data Filtering

All records of the flight of actual aircraft will contain spurious contributions to the data signals arising from electrical noise, instrument errors, structural vibrations, and atmospheric turbulence. Since the model we have chosen to represent the aircraft does not include such effects, it is desirable to remove them, in so far as possible, before submitting the data to the coefficient extraction routine. Not doing so may cause the extraction routine to produce physically-meaningless results.

All filtering schemes proceed from the idea that continuous data signals are composites, each signal made up of sine waves of all frequencies. Each of these sine waves in the composite has a definite amplitude and phase relationship to the other sine waves making up the signal. By suppressing those frequencies which, on the basis of analysis or experience, cannot arise from the aircraft behavior of interest, one can remove most of the spurious contributions to the signal. Traditionally, filtering was done on continuous signals using frequency sensitive passive networks. In the present case, however, the flight data were received in digital form so that the filtering was accomplished mathematically using a computer*.

It is first necessary to represent the data set by its contributing sine waves. Let $f(t_i)_{i=1,2,3,\ldots N}$ represent the points in the data set, i.e., the value of a particular signal at discrete points of time. Let T = the total time over which we choose to make the analysis. Then over the interval $t = 0$ to $t = T$ we obtain a set of N values of the signal which, for reasons of simplicity, we choose to separate by a fixed time interval, $\Delta t = \frac{T}{N-1}$.

In order to reduce the numerical problems encountered with a Fourier series representation of a function, we will let

$$f(t_i) = f_a(t_i) + f_b(t_i) \qquad t_1 \le t_i \le t_N \tag{11}$$

where

$$f_b(t_i) = f(t_1) + \frac{f(t_N) - f(t_1)}{T} t_i \,, \tag{12}$$

and

$$f_a(t_i) = f(t_i) - f_b(t_i) \,. \tag{13}$$

* The data are, nevertheless, just digitized samples of continuous functions. For this reason we have chosen to employ mathematical techniques more appropriate to such functions than the more commonly used digital filtering techniques which seem more appropriate to the analysis of data which are inherently trains of impulses.

We will also add to these data the set

$$f(t_i) = f_c(t_i) + f_d(t_i) \qquad t_N \le t_i \le t_{2N} \tag{14}$$

where

$$f_d(t_i) = f(t_N) - \frac{f(t_{2N}) - f(t_N)}{T}(t_i - T) \tag{15}$$

and

$$f_c(t_i) = f_a(2T - t_i) \ . \tag{16}$$

By this device, the set described by $f_b(t_i)$, $f_d(t_i)$ can always be represented analytically by

$$f_1(t_i) = f(t_1) + \frac{f(t_N) - f(t_1)}{2} - \frac{4}{\pi^2} \sum_{n=1,3,5,\ldots}^{\infty} \frac{f(t_N) - f(t_1)}{N^2} \cos \frac{n\pi t_i}{T} \ . \tag{17}$$

The set represented by $f_a(t_i)$, $f_c(t_i)$ can be expressed by

$$f_2(t_i) = a_o + \sum_{n=1,2,3,\ldots}^{\infty} a_n \cos \frac{n\pi t_i}{T} \ , \tag{18}$$

where

$$a_o = \frac{1}{2T}\int_o^T f_a(t_i)dt + \frac{1}{2T}\int_T^{2T} f_c(t_i)dt \ , \tag{19}$$

and

$$a_n = \frac{1}{T}\int_o^T f_a(t_i)\cos \frac{n\pi t}{T}\, dt + \frac{1}{T}\int_T^{2T} f_c(t_i)\cos \frac{n\pi t}{T}\, dt \ . \tag{20}$$

To carry out the integrations of (19) and (20), we will assume that $f_a(t)$ and $f_c(t)$ are really continuous functions over the interval of interest. The expression $f_a(t_i)$ represents just the value of this function at time t_i, $t_i - t_N$, rather than being an impulse at t_i with an amplitude equal to $f_a(t_i)$. Since the analytical form of $f_a(t)$ is unknown, we must choose some means to represent it. If an original analog record of the data is available, then the functional form used to represent $f_a(t)$ from t_i to t_{i+1} should be chosen such that it does not vary from the original record by more than some small amount anywhere between t_i and t_{i+1}. Two forms are commonly employed for this purpose: a straight line between two adjacent points and a parabola connecting three adjacent points. The unknown function is therefore represented piecewise by a series of elementary functions of the same form. This provides a function which is everywhere continuous but which has discontinuous slopes at the points where the pieces join. The error criterion chosen determines the maximum value of Δt. Usually, the parabolic form will permit a larger Δt for the same error. Note that by approximating the unknown function in this fashion one is in effect already applying some smoothing in the interval (t_i, t_{i+1}) since the regenerated function can never do more than match the approximate form.

The maximum frequency component that can be defined adequately by these representations is one for which $\omega = \frac{\pi}{2\Delta t}$ radians, that is, one described by five samples. Its linear segment representation has a maximum error of 29% and its parabolic segment representation a maximum error of 6%. For a sampling rate of 10/second we should certainly limit our consideration to frequencies of less than 2.5 Hz.

From the foregoing we conclude that, in the absence of the original analog record, we must assume that the sampling rate represented by the data set was <u>at least</u> four times the highest frequency of interest. We experience no difficulty in evaluating a_n for any n we choose, however; this is in sharp contrast to the usual treatments of sampled data where the highest value of n which may be used without obtaining spurious results is half the sampling rate. We come to this result because the integrations of (19) and (20) are carried out analytically although piecewise - in effect providing an infinite sampling rate. To employ the parabolic representation, we take

$$f_a(t_i) = A\,t_i^2 + B\,t_i + C\,, \tag{21}$$

$$f_a(t_{i+1}) = A\,t_{i+1}^2 + B\,t_{i+1} + C\,, \tag{22}$$

$$f_a(t_{i+2}) = A\,t_{i+2}^2 + B\,t_{i+2} + C\,. \tag{23}$$

Then

$$A = \frac{\left[\frac{f_a(t_i) - f_a(t_{i+1})}{t_i - t_{i+1}} - \frac{f_a(t_{i+1}) - f_a(t_{i+2})}{t_{i+1} - t_{i+2}}\right]}{\left[\frac{t_i^2 - t_{i+1}^2}{t_i - t_{i+1}} - \frac{t_{i+1}^2 - t_{i+2}^2}{t_{i+1} - t_{i+2}}\right]} \tag{24}$$

$$B = \frac{f_a(t_i) - f_a(t_{i+1})}{t_i - t_{i+1}} - \left[\frac{t_i^2 - t_{i+1}^2}{t_i - t_{i+1}}\right] A \tag{25}$$

$$C = f_a(t_i) - A\, t_i^2 - B\, t_i \tag{26}$$

and

$$a_o = \frac{1}{2T}\sum_i \int_i^{i+2} \left[A\, t^2 + B\, t + C\right] dt = \frac{1}{2T}\sum_i \left[\frac{A\, t^3}{3} + \frac{B\, t^2}{2} + C\, t\right]_i^{i+2} \tag{27}$$

$$a_n = \frac{1}{T}\sum_i \int_i^{i+2} \left[A\, t^2 + B\, t + C\right] \cos \frac{n\pi t}{T}\, dt$$

$$= \frac{1}{T}\sum_i \left[A\left(2t\, \frac{T^2}{n^2\pi^2} \cos \frac{n\pi t}{T} + \frac{T t^2}{n\pi} \sin \frac{n\pi t}{T} - \frac{2T^3}{n^3\pi^3} \sin \frac{n\pi t}{T}\right)\right.$$

$$\left. + B\left(\frac{T^2}{n^2\pi^2} \cos \frac{n\pi t}{T} + \frac{Tt}{n\pi} \sin \frac{n\pi t}{T}\right) + \frac{CT}{n\pi} \sin \frac{n\pi t}{T}\right]_i^{i+2} . \tag{28}$$

When

$$\begin{vmatrix} f_a(t_i) & - t_i^2 & - t_i \\ f_a(t_{i+1}) & - t_{i+1}^2 & - t_{i+1} \\ f_a(t_{i+2}) & - t_{i+2}^2 & - t_{i+2} \end{vmatrix} < 10^{-5} , \tag{29}$$

the curvature of the data record is insufficient to require the use of a parabolic approximation and a linear approximation to f(t) will provide the same result. In this case

$$f_a(t_i) = M t_i + D \tag{30}$$

$$f_a(t_{i+1}) = M t_{i+1} + D , \tag{31}$$

then

$$M = \frac{f_a(t_{i+1}) - f_a(t_i)}{t_{i+1} - t_i} \tag{32}$$

$$D = f_a(t_i) - M t_i \tag{33}$$

and

$$a_o = \frac{1}{2T} \sum_i \left[\frac{M t^2}{2} + D t \right]_i^{i+1}$$

$$a_n = \frac{1}{T} \sum_i \left[M \left(\frac{T^2}{n^2 \pi^2} \cos \frac{n\pi t}{T} + \frac{Tt}{n\pi} \sin \frac{n\pi t}{T} \right) + \frac{DT}{n\pi} \sin \frac{n\pi t}{T} \right]_i^{i+1} . \tag{34}$$

The complete function is then represented by

$$f(t_i) = f_1(t_i) + f_2(t_i) \qquad t_1 \leq t_i \leq t_N . \tag{35}$$

An alternate form of (35) which involves fewer computations is

$$f(t_i) = f(t_1) + \frac{f(t_N) - f(t_1)}{T} t_i + a_o + \sum_{n=1,2,3,\ldots}^{\infty} a_n \cos \left(\frac{n\pi t_i}{T} \right)$$

$$t_1 \leq t_i \leq t_N . \tag{36}$$

Note that through the use of this procedure only deviations from a type of mean function value must be treated numerically. Fewer data points are therefore necessary to fit the function adequately and fewer harmonics must be calculated to regenerate the deviation portion of the function with acceptable accuracy. The reasons for adding the mirror image of the function from t_1 to t_N as a "tail" to the original function are that (a) it makes the function even, possibly reducing the number of coefficients which must be calculated, (b) it improves the coefficient definition because more data are now included in the integration, and (c) it offers the opportunity to calculate $f'(t_1)$ since the coefficients of its series representation will usually decrease in value with increasing numbers of harmonics. This may not be the case if the "tail" is not added.

For those cases better represented by an odd function, i.e., using only sine terms, one has merely to change the sign of $f_c(t_i)$ to make the function odd. If, however, one is willing to calculate both sine and cosine coefficients and perform the regeneration using both sine and cosine terms, then the "tail" can be dispensed with. Generally, one can obtain a better definition of the function for a given value of n by using both sine and cosine terms. Nevertheless, in some cases an equally good representation can be secured using a sine or a cosine series with less than 2n terms. This practice then results in a savings in computational time. The choice as to which procedure to follow is, until more experience with each is obtained, somewhat arbitrary.

The accuracy with which a parabolic fit represents the data over two time intervals depends of course on the size of Δt. The smallest value of Δt is fixed by the data sampling rate. If a smaller time interval is needed to obtain a satisfactory fit, it is necessary to interpolate points between the sampled values. It has been found that a fifth-order Newtonian interpolation formula generally provides a sufficiently accurate representation to generate the required intermediate points. This formula, for even time increments, is

$$\phi(t) = y_o + \frac{y_1 - y_o}{t_1 - t_o}(t - t_o) + \frac{y_2 - 2y_1 + y_o}{2(t_1 - t_o)^2}(t - t_o)(t - t_1)$$

$$+ \frac{y_3 - 3y_2 + 3y_1 - y_o}{6(t_1 - t_o)^3}(t - t_o)(t - t_1)(t - t_2)$$

$$+ \frac{y_4 - 4y_3 + 6y_2 - 4y_1 + y_o}{24(t_1 - t_o)^4}(t - t_o)(t - t_1)(t - t_2)(t - t_3)$$

$$+ \frac{y_5 - 5y_4 + 10y_3 - 10y_2 + 5y_1 - y_o}{120(t_1 - t_o)^5}(t - t_o)(t - t_1)(t - t_2)(t - t_3)(t - t_4) . \quad (37)$$

$y_0,\ldots,y_5$ represent six values of the function one wishes to interpolate between. These y values correspond to times $t_0,\ldots,t_5$. $\phi(t)$ can be found using this formula for any t between t_0 and t_5 and it may also be used to extrapolate $\phi(t)$ to a short time before t_0 and a short time after t_5. Note that $\phi(t_0) \equiv y_0$, etc.

Now if the slope of the parabolic representation of the function at t_2 approaching from the left is different by more than ε from the slope of the parabolic representation of the function at t_2 approaching from the right, we calculate $\phi(t_{1/2})$ and $\phi(t_{3/2})$ and fit a parabola first through y_0, $\phi(t_{1/2})$, and y_1, and then through y_1, $\phi(t_{3/2})$, and y_2, etc. We can continue to divide the intervals in half until the slope difference at t_2 is less than ε. As a practical matter, however, more than three such divisions will result in excessively long data sets since we begin with as many as 450 points. Three divisions will result in a set of 3593 points. If ε is set to a desirable value, say 10^{-10}, one will usually find that with actual noisy data it will be necessary to interpolate as many points as permissable in order for ε to approach this value. With smooth data, multiple interpolations will not be necessary.

Since the procedure described above permits one to describe a signal time history in terms of its harmonic content, it is therefore possible to reduce the amplitudes of or eliminate certain constituent frequencies from the set before regenerating the signal - in essence filtering out the unwanted contributions to any desired degree - without any disruption of the phase relationships among the remaining contributions. This represents a level of filter performance far above that possible with passive elements in analog circuits. The choice of which frequencies to suppress and to what extent can generally be made on the following grounds:

1. If the aircraft itself is fairly rigid, frequencies above the principal stability modes should decline in amplitude at about 12 db per octave. This means that generally there should be little contribution to the vehicle's response to control surface deflections or changes in power level at frequencies above 1 to 2 Hz. If the data show significant harmonic content above these frequencies, it can usually be traced to engine-or-turbulence-induced structural vibrations or to electrical noise in the signal transducer, encorder, or recorder.
2. Spurious signals at lower frequencies can be separated from the data, provided their magnitudes are known <u>a priori</u>.

Following these guidelines we may now proceed to perform the attenuation of the higher frequency harmonics in a more rigorous fashion. It will be observed that attempts to regenerate functions having substantial high frequency content with a truncated series always lead to a function having considerable "ripple". For example, attempts to represent a square wave with a truncated series will always show a ripple or oscillation about the correct value at the leading edge and the trailing edge of the square wave. This phenomenon is not observed when square waves are passed through low-pass filter networks so that there is obviously some difference between the action of a low-pass filter and mere truncation of the generating series.

It has been demonstrated mathematically (Ref. 7) that to avoid these ripples the variation of a_n with n for (28), for example, must be continuous. Truncating the series representation of a function means that $a_n(n)$ is discontinuous at the last value of n (unless of course the value of a_n for this and all higher values of n is already zero). A desirable low-pass digital filter design is, therefore, one which suppresses the a_n's sharply above a cutoff value for n, one which leaves the values of a_n for $n \leq n_c$ unattenuated, and one which does this in a continuous fashion. One means discussed in the literature (Ref. 7) is to multiply the a_n's in the series representation by the function H(n), where H is defined by

$$H(n) = \begin{cases} 1 & \text{for } n \leq n_c \\ \cos^2\left(\pi \dfrac{n - n_c}{n_c}\right) & \text{for } n_c < n < (3/2)n_c \\ 0 & \text{for } n \geq (3/2)n_c \end{cases} . \qquad (38)$$

H(n), it will be noted, is everywhere continuous and has a continuous first derivative.

The cutoff harmonic can be obtained from the following expression:

$$n_c = \frac{5T}{\pi} .$$

This is equivalent to saying that we will accept all the sine waves required to represent the function without attenuation up to a frequency of 10 radians/sec at which point we begin the "rolloff". We accept no energy in the signal beyond a frequency of 15 radians per second. Of course, n_c can be adjusted to match the response characteristics of the airplane under test. With flight records usually running 30-40 seconds n_c will be about 50 and the maximum value of n needed is about 75. With this constraint (36) becomes

$$\overline{f(t_i)} = f(t_1) + \frac{f(t_N) - f(t_1)}{T} t_i + a_o + \sum_{n=1,2,3,\ldots}^{n=75} a_n H(n) \cos\left(\frac{n\pi t_i}{T}\right)$$

$$t_1 \leq t_i \leq t_N \qquad (39)$$

Usually, n_c can be adjusted downward if the flight maneuver is carried out with less than maximum aircraft response.

One of the more common types of noise in flight test data is caused by the failure of the digital encoding or conversion device to register the higher order bits. When this happens there is a sudden small jump in the indicated value. These jumps are generally in the same direction and do not occur in a completely random fashion. As a result, they cannot be treated as gaussian noise; further, they introduce a bias error into data filtered by our fourier routine. One means of dealing with this problem is to recognize that the aircraft states are dynamically capable of only finite rates of change. The change in altitude pressure with time, for example, is limited by the airspeed, altitude, and flight path angle. Any pressure change in excess of this value is obviously spurious. In place of the spurious value we can take the value determined from the vehicle dynamics through the following process:

Assume altitude temperature is equal to standard sea level value. Then

$$\dot{P} = 4.26P_o(1 - 6.86 \times 10^{-6}h)^{3.26}(- 6.86 \times 10^{-6})\dot{h}$$

But $\dot{h} = V\sin\gamma = V\sin(\theta - \alpha)$.

So $$\dot{P} = 4.26P_o\left(\frac{P}{P_o}\right)^{\frac{3.26}{4.26}}(- 6.86 \times 10^{-6})V\sin(\theta - \alpha).$$

θ and α come from instrument readings. To allow for errors in these values we take as the maximum value

$$\dot{P}_{max} = - 2.922 \times 10^{-5} P_o^{0.2347} P^{0.76526} V\sin[1.2(\theta - \alpha)]. \qquad (40)$$

Thus the next pressure value cannot change more than $\dot{P}\Delta t$ from the previous value. If it does, we are justified in replacing the indication by $P_{Previous} + \dot{P}\Delta t$.

Although this procedure will not eliminate the effects of "bit dropout," it will reduce materially the bias and low frequency errors which normally result therefrom. The Fourier procedure is then much more likely to yield the accurate data needed for effective parameter extraction.

Computation of Derivatives

The drag and power extraction scheme presented above requires that at least one parameter ($\dot{\alpha}$) which is not commonly measured be supplied as an input time history. We are therefore forced to differentiate $\alpha(t)$ in some fashion in order to obtain $\dot{\alpha}(t)$. Because of the fourier series representation used in (39), we may easily compute the derivative of this function analytically:

$$f'(t_i) = \frac{f(t_N) - f(t_i)}{T} - \frac{\pi}{T} \sum_{n=1,2,3,\ldots}^{n=75} a_n \, n \, H(n) \sin\left(\frac{n\pi t_i}{T}\right)$$

$$t_1 \leq t_i \leq t_N \, . \tag{41}$$

This process may be applied to any data set for which a derivative is needed and for which it is otherwise unavailable.

Some examples of the application of this procedure are shown in figures 25-26. In figure 25 an angle-of-attack time history as read from a "quick look" record is reproduced. Note the high degree of irregularity. This data was read every 1/4 second. When submitted to the fourier analysis routine with $n_c = 10$, the smooth curve shown in figure 25 is obtained. The angle of attack rate is shown in figure 26. The data are quite smooth and appear to be a reliable smoothing of the original. The maneuver for which these data were obtained was a pushover-pullup. The "humps" in the data at roughly 6-second intervals are believed to be a consequence of the excitation of the aircraft's longitudinal short period mode by the maneuver. Calculations indicate the short period mode can be expected to have this period for the test configuration.

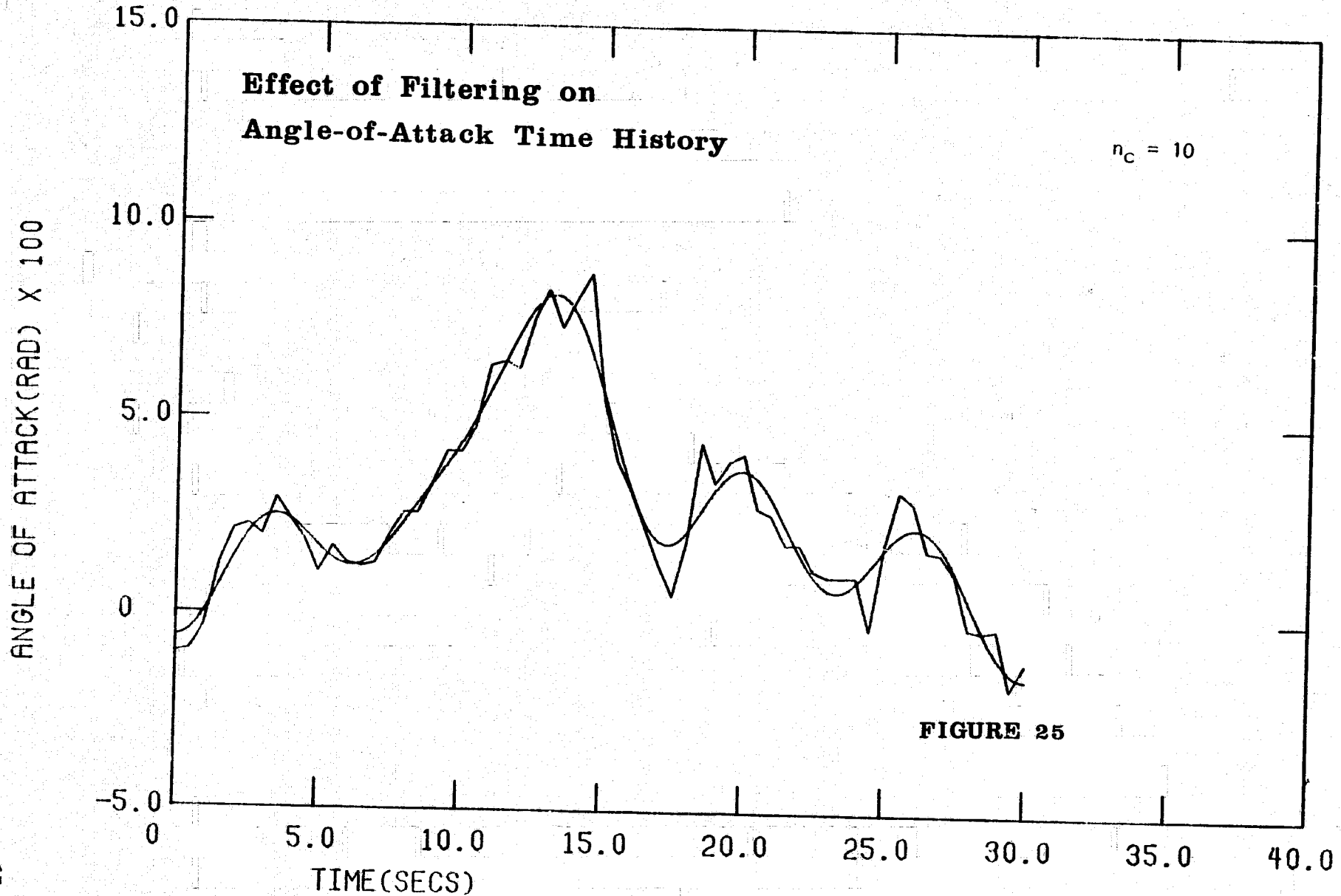

Effect of Filtering on
Angle-of-Attack Time History
n_c = 10
ANGLE OF ATTACK(RAD) X 100
15.0
10.0
5.0
0
-5.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 25

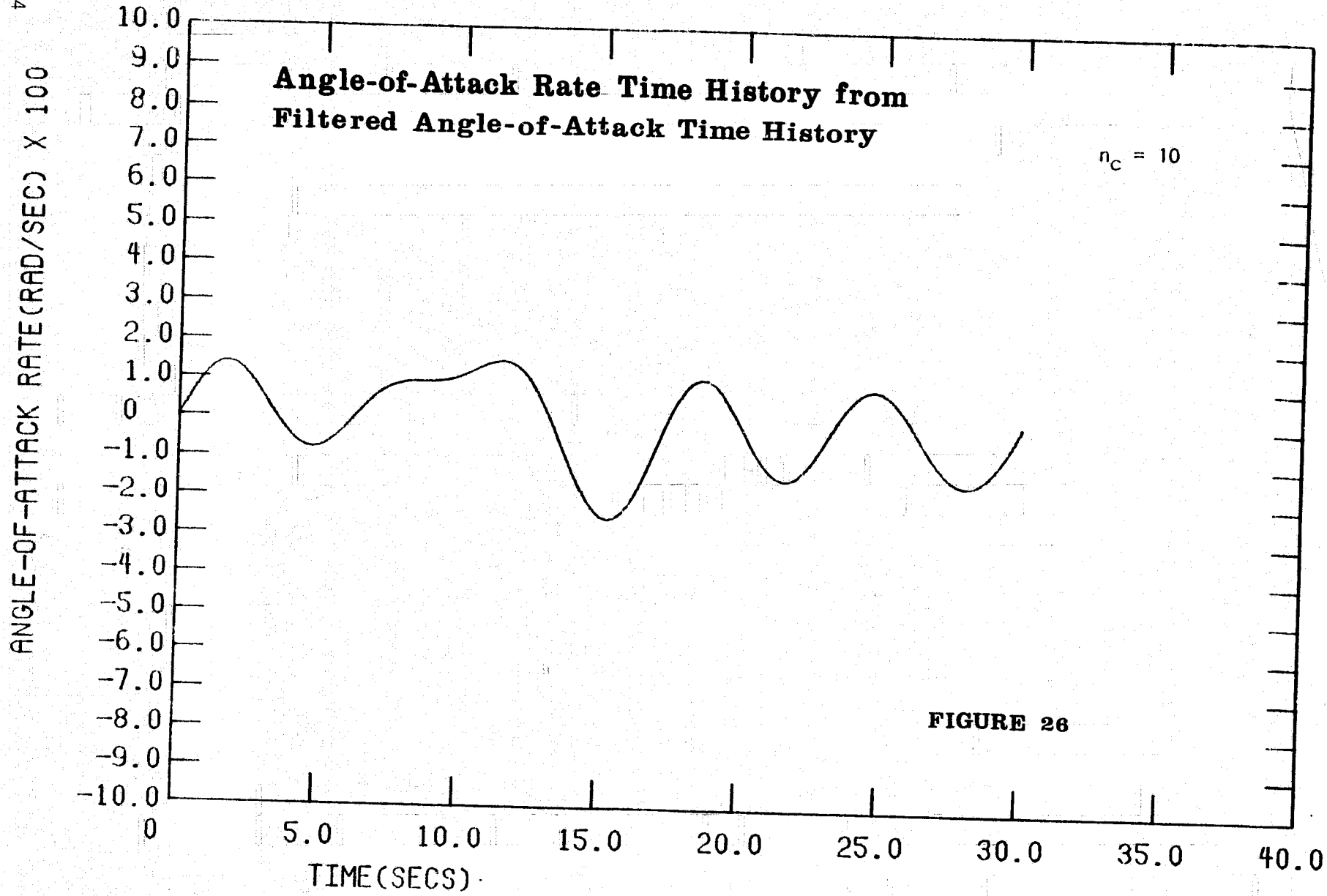

Angle-of-Attack Rate Time History from
Filtered Angle-of-Attack Time History
n_c = 10
ANGLE-OF-ATTACK RATE(RAD/SEC) X 100
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 26

Comparison of Computed Acceleration Along the Flight Path with that Determined from Accelerometer Indications

The scheme to extract drag and thrust simultaneously from flight data has been found to require accurate indications of the acceleration along the vehicle's flight path in order to yield acceptable results. Usually it is not possible to locate the measuring instrument (accelerometer) precisely at the vehicle's center of gravity, so that it is necessary to correct the instrument's indication for this fact and then to relate the acceleration along the vehicle's x-body axis to the longitudinal acceleration along the flight path.

Accelerometers are generally masses constrained to move along the axis of a tube and centered by springs at either end. The position of the mass relative to the center of a tube is proportional to the acceleration and is measured electrically. When the aircraft accelerates along the flight path, the mass moves aft of the center of the tube. Now, the same effect is produced when the accelerometer is tilted nose up even though there is no acceleration. Thus, it is necessary to subtract a term g sin θ from the accelerometer indication to account for this effect.

If the accelerometer is located x feet in front of the c.g., its mass is caused to move forward as a result of the angular rotation of the aircraft by an amount $x\,q^2$. One must therefore add this term to the accelerometer indication. Similarly, if the accelerometer axis is located z feet below the x-body axis then the accelerometer mass is displaced rearward by an amount proportional to $z\,\dot{q}$.

The linear acceleration along the x-body axis in terms of the accelerometer indication location, and angular velocity is therefore

$$a_x = a_{x_{ind}} - g \sin\theta + x\,q^2 - z\,\dot{q} \,. \tag{42}$$

We desire the acceleration not along the x-body axis but rather along the flight path. We know that for motion in the x-z terrestrial plane

$$a_x = \dot{u} + q\,w \tag{43}$$

and

$$u = V \cos\alpha \tag{44}$$

$$w = + \sin\alpha \,, \tag{45}$$

where V is the velocity of the aircraft along its flight path and u and w are components of this velocity along the principal axes of the aircraft. In terms of (44) and (45)

$$a_x = \dot{V} \cos \alpha - V \dot{\alpha} \sin \alpha + q V \sin \alpha$$

$$= \dot{V} \cos \alpha - V(\dot{\alpha} - q) \sin \alpha \, . \qquad (46)$$

Equating (42) and (46) yields

$$a_{x_{ind}} - g \sin \theta + x q^2 - z \dot{q} = \dot{V} \cos \alpha - V(\dot{\alpha} - q) \sin \alpha \, . \qquad (47)$$

Then solving for $\dot{V}$, one has

$$\dot{V} = \frac{a_{x_{ind}} - g \sin \theta + x q^2 - z \dot{q}}{\cos \alpha} + V(\dot{\alpha} - q) \tan \alpha \, . \qquad (48)$$

The value given by (48) should now be the same as that obtained by differentiating the variation of <u>true</u> airspeed with time. The differences between a raw accelerometer indication and the derivative of the true airspeed with time for an actual flight record are shown in figure 27.

Of course one does not measure true airspeed directly. An airspeed sensor measures only a pressure difference. This difference is affected by the sensitivity of the pitot and static pressure sources to angle of attack, the disturbance to the free stream pressure at the static pressure source resulting from the presence of the aircraft, the compressibility of the air, and the difference in pneumatic lags of the pitot and static pressure lines. The pneumatic lag also introduces a <u>time</u> delay in the airspeed indication. Since the airspeed indicator is calibrated for standard sea level conditions, any variation in atmospheric temperature will affect the airspeed at a given pressure difference.

The theory of the pitot-static tube assumes that the air is brought to rest at the pitot pressure source adiabatically and that the static source senses the pressure in the free stream (i.e., away from the airplane). With these assumptions, it is easy to show that the true flow velocity is related to the measured pressures by

$$V = \sqrt{\frac{2\gamma RT}{(\gamma-1)} \left\{ \left[\frac{q_c}{P} + 1 \right]^{\frac{\gamma-1}{\gamma}} - 1 \right\}} \, , \qquad (49)$$

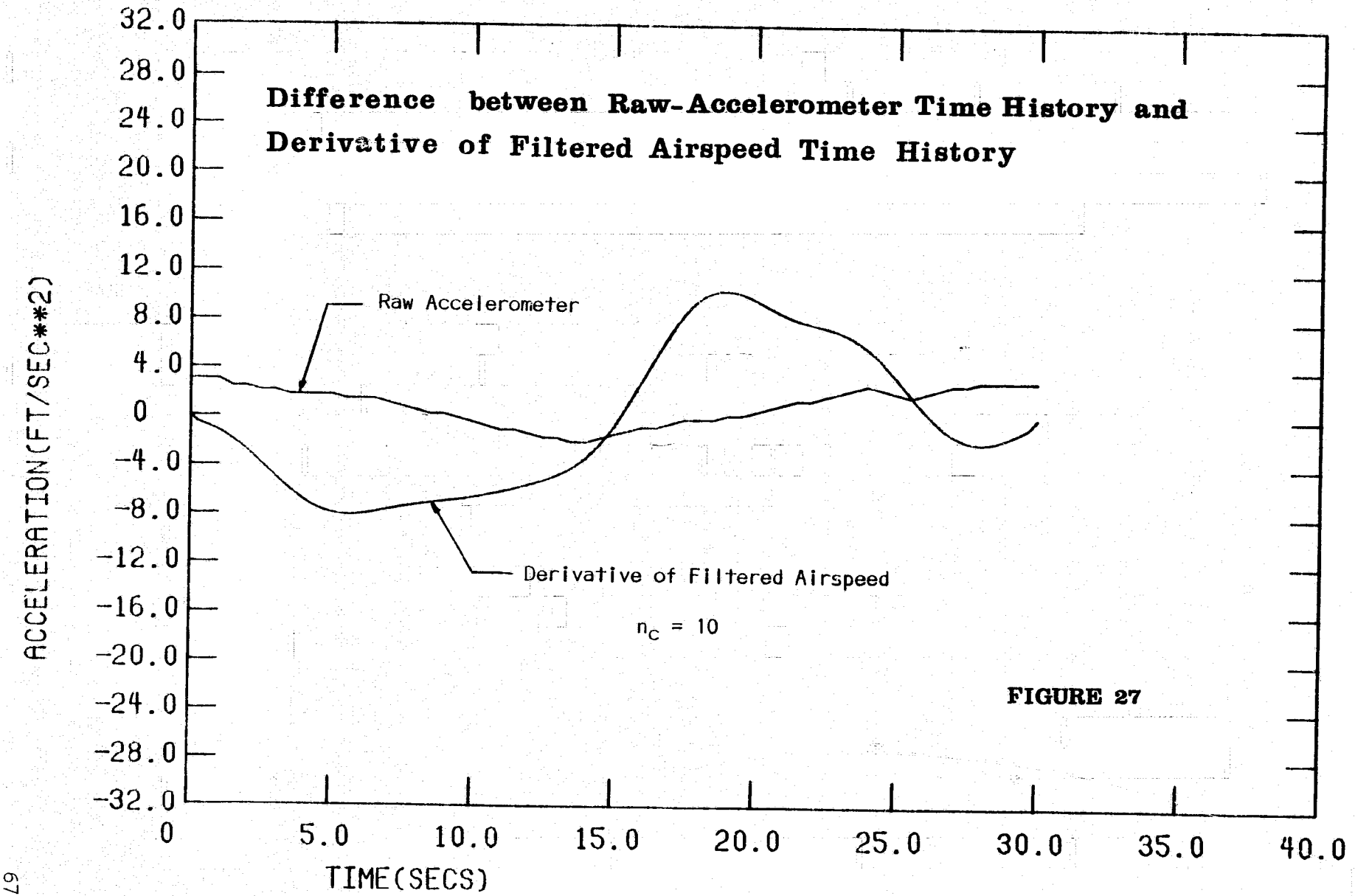

Difference between Raw-Accelerometer Time History and Derivative of Filtered Airspeed Time History
Raw Accelerometer
Derivative of Filtered Airspeed
n_c = 10
ACCELERATION(FT/SEC**2)
TIME(SECS)
32.0
28.0
24.0
20.0
16.0
12.0
8.0
4.0
0
-4.0
-8.0
-12.0
-16.0
-20.0
-24.0
-28.0
-32.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0

FIGURE 27

where P is the altitude pressure, q_c is the difference between the pitot and static pressures, T is the local free stream absolute temperature, R is the gas constant for air and γ is the ratio of specific heats of air (1.4 for diatomic gases at normal temperatures). The P indication for use in this equation comes from the static pressure source of the pitot-static tube and the T indication from a temperature measuring device. Since one cannot measure the local free stream temperature readily while the vehicle is in motion, temperature sensing devices most often measure the stagnation temperature, T_s, which is related to the free stream temperature by

$$T = \frac{T_s}{\left[\frac{q_c}{P} + 1\right]^{\frac{\gamma-1}{\gamma}}} . \tag{50}$$

In terms of the stagnation temperature, the true airspeed is given by

$$V = \sqrt{\frac{2\gamma R T_s}{(\gamma-1)} \left\{1 - \left[\frac{q_c}{P} + 1\right]^{\frac{1-\gamma}{\gamma}}\right\}} . \tag{51}$$

Unfortunately, it is usually not possible to locate the static pressure source on an airplane in a region where the static pressure is the same as the free stream value. Hence, the static pressure indication is in error by an amount ΔP. This "position error" so called is felt in both the altitude and q_c indications. If we call P' the measured altitude pressure and q_c' the measured pressure difference then because

$$q_c' + P' = q_c + P = P_s , \tag{52}$$

and

$$P = P' - \Delta P ,$$

one can write

$$\frac{q_c + P}{P} = \frac{q_c' + P'}{P' - \Delta P} = \frac{1 + \frac{P'}{q_c'}}{\frac{P'}{q_c'} - \frac{\Delta P}{q_c'}} , \tag{53}$$

in terms of the measured values and the static source position error which is usually determined by flight calibration and is expressed in terms of $\frac{\Delta P}{q_c'}$ as a function of q_c' or indicated airspeed. With this effect included the expression for true airspeed becomes

$$V = \sqrt{\frac{2\gamma RT_s}{(\gamma-1)}\left\{1 - \left[\frac{1 + \frac{P'}{q_c'}}{\frac{P'}{q_c'} - \frac{\Delta P}{q_c'}}\right]^{\frac{1-\gamma}{\gamma}}\right\}} \quad . \tag{54}$$

Fortunately, modern pitot-static tubes are relatively insensitive to changes in angle of attack so that the q_c' and P' indications do not depend on the tube's inclination to the airstream over the useful range of aircraft angles of attack. The position error, however, does depend upon angle of attack and aircraft configuration. At steady speed and constant weight the position error can be related, as it commonly is, to q_c' or indicated airspeed, but during maneuvers it may be necessary to employ a correlation with angle of attack instead. Whether this is necessary must be determined by calibration. If it is, one must then determine true airspeed and true angle of attack iteratively.

The compressibility correction mentioned earlier is already included in (54). Conventional airspeed indicators, it may be noted, are simply mechanizations of the equation

$$V_i = \sqrt{\frac{2q_c}{\rho_o}} \quad , \tag{55}$$

where ρ_o is the mass density of the air at standard sea level conditions. If the airspeed indicator calibration includes compressibility effects, equation (49) with standard sea level pressure and temperature is mechanized.

If pneumatic signals transmitted through the pitot and static lines travel at different speeds* then the q_c' and P' values will be in error. In most aircraft with pressure sensors located in the cabin area the pneumatic lines are long enough that their response characteristics can be considered analogous to those of resistance-capacitance electrical circuits. The "resistance" is proportional to length/(diameter)^4 while the "capacitance" is proportional to system volume. Since the static system includes more instruments than the pitot system and, frequently, larger volumes, the static line diameter must be larger than the pitot or a restriction must be placed in the pitot line in order to keep the response times equal. Even if the line responses are equal, V(t) will lag the correct value by a time which is proportional to h and $\dot{V}$.

A procedure by which equation (54) may be modified to account for lag is the following: We begin by recalling that the equation describing the axial motion of a compressible fluid in a tube is

* Speed is used here in the sense of the time or rate at which the transducer indication responds to changes in the aircraft's pressure field. It does not refer to the speed at which acoustic signals are propagated through pneumatic lines.

$$\rho \frac{\partial u}{\partial t} + \rho u \frac{\partial u}{\partial x} = - \frac{\partial P}{\partial x} + \frac{\partial}{\partial x} \left(\mu \frac{\partial u}{\partial x} \right) + \frac{1}{r} \frac{\partial}{\partial r} \left(\mu r \frac{\partial u}{\partial r} \right) . \qquad (56)$$

Here u is the fluid velocity, μ the coefficient of viscosity, x the axial distance and r the radial distance. In conjunction with the foregoing, one may also write the equation describing the conservation of matter

$$\frac{\partial \rho}{\partial t} + \rho \frac{\partial u}{\partial x} + u \frac{\partial \rho}{\partial x} = 0 . \qquad (57)$$

Examination of the first equation reveals it to be a mixed parabolic and elliptic-type non-linear partial differential equation. As such there are at least two characteristic propagational velocities by which the fluid adjusts itself to changing boundary conditions. One is infinite. The other, as we may discover by temporarily ignoring the effects of fluid viscosity, is approximately what we understand as the speed of sound. This characteristic information transfer mechanism is always present. The importance of the infinite propagational velocity in determining the gross behavior of the fluid motion depends, of course, on the relative importance of the viscous stress terms in the equation.

The reason for relating the foregoing bit of mathematical wisdom is that we cannot solve the equation for typical boundary conditions without prodigious effort and must therefore resort to some gross approximations. Under these conditions it is desirable to extract as much information as possible about the character of the solution of the general equation in order to ascertain the reasonableness of the approximate solutions.

Suppose we model the aircraft static or total pressure systems as a very long straight tube terminated on the instrument end by a finite volume. Let us assume that the flow through this tube is always <u>isothermal</u>, i.e., it is slow enough that heat can be transferred to and from the tube walls as a fluid particle traverses the length of the tube. The pressure in the volume at the instrument end of the tube is then directly proportional to the mass flux through the tube to the volume. Depending upon the ratio of the pressures across the tube and the tube length,

$$\dot{m} \sim P_\infty \text{ for short tubes and } P_\infty / P_{instrument} \geq 2 \qquad (58)$$

$$\dot{m} \sim \sqrt{P_\infty - P_{instrument}} \text{ for short-to-intermediate length tubes and } P_\infty / P_{instrument} < 2 \qquad (59)$$

$$\dot{m} \sim (P_\infty - P_{instrument}) \text{ for very long tubes.} \qquad (60)$$

These results can all be obtained from the foregoing equations and the equation of state, $P = \rho RT$, after some manipulation. The first two results are obtained assuming $\mu = 0$. The second assumes in addition that the velocity is slow enough that $\rho \approx$ constant. The third result is obtained by assuming that the viscous stresses are sufficiently important that the terms on the left side of the equation are small by comparison. This of course is only true in very long tubes ($L/D > 100$). The instantaneous rate of change of pressure in the instrument volume is then

$$\dot{P}_{instrument} = (P_\infty - P_{instrument}) \frac{1}{\tau} \tag{61}$$

where τ is a proportionality constant having the units of time. Note that in general both P_∞ and $P_{instrument}$ may change with time. From this expression it is easy to show that in terms of the instrument reading

$$P_\infty = P_{instrument} + \tau \dot{P}_{instrument} . \tag{62}$$

τ is determined empirically by allowing P_∞ to change instantaneously from one value to another. For this case we may easily write

$$\frac{dP_{instrument}}{(P_\infty - P_{instrument})} = \frac{dt}{\tau} , \tag{63}$$

whose solution is

$$- \ell n \, (P_\infty - P_{instrument}) = t/\tau + c . \tag{64}$$

the boundary conditions are

$$\text{when} \quad t = 0, \; P_{instrument} = P_{instrument_o}$$

$$\text{when} \quad t \to \infty, \; P_{instrument} \to P_\infty ,$$

thus

$$P_{instrument} = P_{instrument_o} e^{-t/\tau} + P_\infty (1 - e^{-t/\tau}). \tag{65}$$

By measuring P_∞, $P_{instrument}$, $P_{instrument_o}$, and time, τ is readily determined.

The above analysis assumes that a change in P_∞ is instantly communicated to the gas in the instrument volume. Because acoustic waves are the dominant communication mechanism when the fluid is essentially at rest, changes in P_∞ are felt in the instrument volume some λ seconds later with the arrival of the acoustic wave generated by the change in P_∞. λ can also be measured experimentally. With this effect included the air pressures at the pitot-static opening in terms of the instrument readings are represented by

$$P_\infty(t) = P_{\text{instrument}}(t + \lambda) + \tau \dot{P}_{\text{instrument}}(t + \lambda) \tag{66}$$

Note that P_∞ at t seconds is given in terms of the instrument reading and its instantaneous rate of change at $(t + \lambda)$ seconds.

If now q_c'' is the lag-free value of the impact pressure,
P'' is the lag-free value of the static pressure,
P_s'' is the lag-free value of the stagnation pressure,
τ_1, λ_1 / τ_2, λ_2 are, respectively, the measured time constants of the stagnation and static systems,

then

$$q_c''(t) = P_s'' - P_s'(t + \lambda_1) + \tau_1 \dot{P}_s'(t + \lambda_1) - P'(t + \lambda_2) - \tau_2 \dot{P}'(t + \lambda_2). \tag{67}$$

$$P''(t) = P'(t + \lambda_2) + \tau_2 \dot{P}'(t + \lambda_2) \tag{68}$$

These values of q_c'' and P'' should be substituted for q_c' and P' in equation (54) to obtain a lag-free value of $V(t)$.

Typical values for the ATLIT flight test system are

τ_1 = 0.040 seconds
λ_1 = 0.025 seconds
τ_2 = 0.150 seconds
λ_2 = 0.033 seconds
$\dot{V}_{max}$ = ± 8 ft/sec^2 @ 120 ft/sec

P_s = 2133 psf @ S.L. and 120 ft/sec

P = 2116 psf @ S.L.

$\dot{h}$ = 35 ft/sec

With these numbers

$$q_c'' = 2133 - .040\ (2.358976) - 2116 + 0.15\ (2.1635)$$

$$= 2133 - .094359 - 2116 - .324525 = 17.23 \text{ psf while } q_c' = 17 \text{ psf.}$$

the error in q_c' is therefore 0.23 psf or 1.35% while the error in P is 0.0153%. Thus it appears that if one seeks to minimize data errors a lag correction in the airspeed is required.

When all necessary corrections have been made to the pressure indications, one can create V(t) by use of equation (54). These data can then be submitted to the Fourier analysis procedure to smooth V(t) and to find $\dot{V}(t)$. As noted above, this value should agree closely with that determined from equation (48) if the totality of the data are self-consistent. Observe, however, that the latter computation requires that one input five separate measurements plus the derivatives of two, while the former only requires three measurements plus some calibration data. Thus, it is to be expected that $\dot{V}$ computed from pressure and temperature data will generally be the more reliable value.

Correction of Angle of Attack Indications

In addition to factors such as transducer linearity, gain, and bias, the angle of attack indication is affected by the presence of the carrying aircraft and by its rotation. It will be recognized that for an angle of attack vane located x feet ahead of the c.g. an incremental angle,

$$\Delta\alpha = \tan^{-1}\left(\frac{xq}{V}\right), \tag{69}$$

must be subtracted from the transducer indication to account for vehicle rotation. In addition, there is usually a relationship of the type

$$\alpha_{true} = C_1\ \alpha_{indicated} + C_2\ , \tag{70}$$

between the angle of attack measured in the neighborhood of the aircraft and the true (i.e., at infinity) angle of attack. The values of C_1 and C_2 depend

upon the location of the vane relative to the aircraft and the geometry of the aircraft. They are therefore almost always found from flight calibration tests since the flow field about complex shapes such as complete aircraft is almost impossible to determine analytically. Assuming that these coefficients are known, one may write the expression for true angle of attack as

$$\alpha_{true} = C_1 \left(\alpha_{indicated} - \tan^{-1} \left(\frac{xq}{V} \right) \right) + C_2 \, . \qquad (71)$$

Note that the value of V used in (71) should be that obtained from (54). One may then smooth $\alpha_{true}(t)$ and compute the derivative, $\dot{\alpha}(t)$, by the Fourier analysis procedure.

Determination of $\rho(t)$

Equation (6) requires as an input $\rho(t)$. This is readily determined from

$$\rho = \frac{(P' - \Delta P)}{RT_s} \left[\frac{1 + \frac{P'}{q_c'}}{\frac{P'}{q_c} - \frac{\Delta P}{q_c'}} \right]^{\frac{\gamma - 1}{\gamma}} \, . \qquad (72)$$

If the altitude pressure transducer is calibrated in feet, then the appropriate pressure versus altitude function must be employed to convert the indications to pressure values.

The density values may also require smoothing before the data can be inserted into (10).

Conditioning of Other Data Inputs to the Drag and Power Extraction Method

In addition to the velocity, angle of attack, and atmospheric density, equations (10) require W(t) and $\theta(t)$ as inputs. Fortunately, for the maneuvers of interest W changes so little that it can be taken to be constant or at most varying linearly during a maneuver. Usually θ requires no corrections beyond the instrument calibration if the erection mechanism is disabled during the maneuver. Since the indication is sampled and since there may be electrical, airframe, and turbulence-induced noise, smoothing may still be necessary. This is also true for the pitch rate indication, q, which is used in the C_L computation and the α and a_x corrections.

More General Power and Drag Models

In a normally-aspirated engine the manifold pressure and hence the power output for a given throttle setting will usually vary directly with the atmospheric density. Thus, if the maneuver to provide data for the power and drag extraction process involves a change in altitude, there will be a change in power at a given speed corresponding to the change in ρ even if the pilot does not change his throttle setting or RPM. To account for this we need to multiply the expression for power by (Ref. 8)

$$\frac{\rho_{ref}/\rho_o - 0.165}{\rho/\rho_o - 0.165}, \tag{73}$$

where ρ_o is the standard sea-level value of ρ and ρ_{ref} is the value of ρ at the beginning of the maneuver.

The parabolic form of the speed-power relation used in equation (6) is obviously satisfactory over small differences in speed and should represent the thrust horsepower of fixed-pitch propellers reasonably well over most of the aircraft's speed envelope. The higher efficiency levels provided by a constant speed propeller at the lower speeds, however, makes it necessary to employ a higher order polynomial or other function having additional degrees of freedom (coefficients) to represent the thrust horsepower adequately over a wide speed range. Variants of one such function were chosen for further study:

$$P = P_1 + \frac{P_2}{V^{1/2}} + P_3 V + P_4 V^2 + P_5 V^3 \tag{74}$$

These are shown in Table IIIa.

One will note also that the drag expression is really satisfactory only if α is measured from zero lift. Since the angle reference for flight data is often quite arbitrary, it is difficult to establish the angle for zero lift *a priori*. To accommodate an arbitrary reference, i.e., to replace α by $\alpha - \alpha_o$ in equation (5), requires that the representation for C_D contain all powers of α through 6. We choose, however, to investigate only three variants of the following form which are shown in Table IIIa:

$$C_D = C_{D_0} + C_{D_1}\,\alpha + C_{D_2}\,\alpha^2 + C_{D_3}\,\alpha^3 + C_{D_4}\,\alpha^6. \tag{75}$$

POWER AND DRAG COEFFICIENT MODELS

(1) $P = P_0$

(2) $P = P_0 + P_1/V^{\frac{1}{2}}$

(3) $P = P_0 + P_2V$

(4) $P = P_0 + P_1/V^{\frac{1}{2}} + P_2V$

(5) $P = P_0 + P_2V + P_3V^2$

(6) $P = P_0 + P_1/V^{\frac{1}{2}} + P_2V + P_3V^2$

(7) $P = P_0 + P_2V + P_3V^2 + P_4V^3$

(8) $P = P_0 + P_1/V^{\frac{1}{2}} + P_2V + P_3V^2 + P_4V^3$

(1) $C_D = C_{D_0} + C_{D_2}\alpha^2$

(2) $C_D = C_{D_0} + C_{D_2}\alpha^2 + C_{D_4}\alpha^6$

(3) $C_D = C_{D_0} + C_{D_1}\alpha + C_{D_2}\alpha^2 + C_{D_3}\alpha^3 + C_{D_4}\alpha^6$

TABLE III-a

RECOVERED RESULTS WITH VARIOUS MODELS

NOISE-FREE

Model	C_{D_0}	C_{D_1}	C_{D_2}	C_{D_3}	C_{D_4}
1-1	0.025010125		4.189265490		
1-2	0.027715936		1.840217248		2218.55390095
1-3	0.193206335	-5.536545497	55.990804759	-190.595121623	6365.50170689
2-1	0.041300870		3.314574182		
2-2	0.041723838		1.369905822		1934.85508995
2-3	0.032149511	0.256910853	1.083170012	-6.930257732	2636.82627991
3-1	0.052512561		3.397605844		
3-2	0.053437421		1.223230343		2098.00447603
3-3	0.104358253	-1.981087659	19.854161098	-61.409698497	3230.30712823
4-1	-0.007815849		3.258242555		
4-2	0.047922733		1.291498595		2019.91892771
4-3	0.043314322	0.136168241	0.321188551	2.111106052	2052.79056339
5-1	-0.140402432		3.358351516		
5-2	0.035099999		1.289155014		2030.80086563
5-3	0.035099999	9.0×10^{-10}	1.289155007	1.9×10^{-8}	2030.80086599
6-1	0.851148482		2.718117586		
6-2	0.019408889		1.334792323		1977.60389095
6-3	0.035100000	-1.8×10^{-9}	1.289155029	-4.1×10^{-8}	2030.80086584
7-1	7.097803213		-2.479854764		
7-2	0.035099997		1.289155018		2030.80086585
7-3	0.035099849	3.35×10^{-7}	1.289152488	6.77×10^{-6}	2030.80087789
8-1	-6.419749124		8.756565254		
8-2	0.035099983		1.289155030		2030.80086168
8-3	0.035100002	-9.7×10^{-8}	1.289155975	-3.4×10^{-6}	2030.80094408

TABLE III-b

RECOVERED RESULTS WITH VARIOUS MODELS

NOISE-FREE

Model	P_0	P_1	P_2	P_3	P_4
1-1	172998.85079				
1-2	157655.47027				
1-3	127308.04933				
2-1	371192.98528	-2517765.9582			
2-2	334247.89394	-2218423.0065			
2-3	357094.45551	-2438740.6304			
3-1	69229.86429		701.819787		
3-2	60885.13175		660.124537		
3-3	84876.34799		410.940847		
4-1	1497321.54687	-11640184.7950	-2759.609819		
4-2	190924.27594	-1057400.1205	347.238354		
4-3	208960.25776	-1218458.9820	321.099439		
5-1	-272355.27164		5603.220066	-22.8622086	
5-2	28735.71416		1126.607146	-2.1696429	
5-3	28735.71414		1126.607143	-2.1696428	
6-1	11652672.75547	-77120339.5902	-52677.486678	142.0135471	
6-2	18.26865	-1.35×10^{-10}	1536.512079	-4.0512608	
6-3	28735.71427	-1.71×10^{-5}	1126.607143	-2.1696429	
7-1	-1038549.98441		20472.763195	-119.6962928	1.496383665
7-2	28735.71431		1126.607142	-2.1696429	-5.35×10^{-10}
7-3	28735.71429		1126.607056	-2.1696417	-2.80×10^{-8}
8-1	25533616.98900	-1.6×10^{8}	-133353.421168	433.4378086	-1.726554460
8-2	28735.71427	4.5×10^{-7}	1126.607134	-2.1696427	-3.2×10^{-9}
8-3	28735.71633	3.2×10^{-4}	1126.607117	-2.1696428	-2.2×10^{-10}

TABLE III-c

The three drag expressions and the eight power expressions give us a total of 24 analytical models with which we can attempt to fit experimental data. It will probably be necessary to employ all of the models or at least this number of models until experience with data for a particular aircraft permits one to discard those models which do not apply. The results obtained by fitting all these models to the theoretical data of figure 24 are shown in Table IIIb. If one compares the results for case 5-2 with figures 22 and 23, one will see immediately the very good agreement which the extraction method can provide.

One may also ask why should one also employ a model which is simply a reduced form of a more general model? The answer lies in the extreme sensitivity of the coefficient solutions to small errors in the data. Generally, the more general models are more sensitive to these errors so that under these circumstances a simpler form may yield reasonable results whereas the more general form may yield nonsense numbers. It should be recalled that since any power, if accompanied by a suitable drag, will solve the equation of motion, these physically absurd numbers are legitimate mathematical solutions. How then does one determine whether the solutions obtained are reasonable?

The first means of assessing the reasonableness of the solution set is to use them along with the experimental data in the proper form of equation (8). For 300 data points a value of $S < 10^{-13}$ generally indicates coefficient values within 1% or so of the correct values. (For the exact coefficient values, $S < 10^{-21}$.) Coefficient values in error by 5%, for example, may still be of interest, but with errors of this size it may become difficult to identify the best model and coefficient set merely by checking to see which model gives the smallest value of S. S_{min} will now be on the order of 10^{-6} for 300 points, but the coefficient set for S_{min} may give absurd powers and drags. For this reason it is desirable to add a second constraint which an acceptable model and coefficient set must satisfy: The horsepower for any speed must be positive and less than Y (Y = 400 for ATLIT); C_D must be positive and less than Z (Z = 0.12 for ATLIT) for any α. One frequently finds that with noisy data very few of the 24 coefficient sets satisfy this second constraint.

Effect of Data Errors on Coefficient Extractions

We have noted above that by operating on exact data it is possible for the coefficient extraction procedure to recover the values of the coefficients in the power and drag polynomials to six significant figures. We have also noted that this procedure is quite sensitive to data inaccuracies. In order to place some quantitative bound on this sensitivity, the exact input data were artificially degraded and resubmitted to the coefficient extraction procedure to determine how the coefficient values were altered. Two types of degradation were employed: random noise and constant bias. For the random noise a random number generator was employed at each 0.1 seconds of each trace and the output scaled so as to be 1% of the maximum value of the function, e.g., 1% of the maximum value of V(t) during the maneuver. These scaled noise values were then added to the exact function values to obtain the degraded data. For this experiment, all data which would normally be measured in flight were degraded. This was too noisy. No coefficient set would satisfy the reasonableness criterion.

The data were then filtered with $n_c = 10$. For comparison, the filtered and unfiltered data are shown in figure 28. Note that the filtering routine does a very good job of removing the high frequency noise. Note also that employing a random number generator in the manner indicated means that the random noise usually has a non-zero mean (bias error). Despite the filtering, the coefficient extraction routine would not yield reasonable results. It also failed for $n_c = 6$ and $n_c = 4$. The magnitude of the random contributions was then reduced from 1% of maximum signal to 0.1%. With no filtering the extraction procedure again failed. However, with filtering ($n_c = 6$), two models gave reasonable results. These were

$$P = 371959.0785 - \frac{2702612.22}{V^{1/2}}$$

$$C_D = .00676 + 1.52053\alpha - 18.77305\alpha^2 + 87.8915\alpha^3 - 1295.7649\alpha^6$$

and

$$P = 16594.89367 + 1308.3421V - 3.024425V^2$$

$$C_D = .027766 + 1.345608\alpha^2 + 1985.1565\alpha^6.$$

The second of these (see also Table IV) is the correct functional form. Although the coefficient values for this form individually are in error by as much as 73%, the recovered power, for example, is only in error by 6.3% at 200 ft/sec. The errors in drag are even smaller.

RECOVERED RESULTS WITH RESIDUAL NOISE

1/10 of 1% Random Noise
$n_c = 6$

Model 2-3

$P_0 =$ 371959.0785

$P_1 =$ -2702612.2226

$C_{D_0} =$ 0.006761

$C_{D_1} =$ 1.520529

$C_{D_2} =$ -18.773051

$C_{D_3} =$ 87.891504

$C_{D_4} =$ -1295.764876

Model 5-2

$P_0 =$ 16594.89367

$P_2 =$ 1308.34213

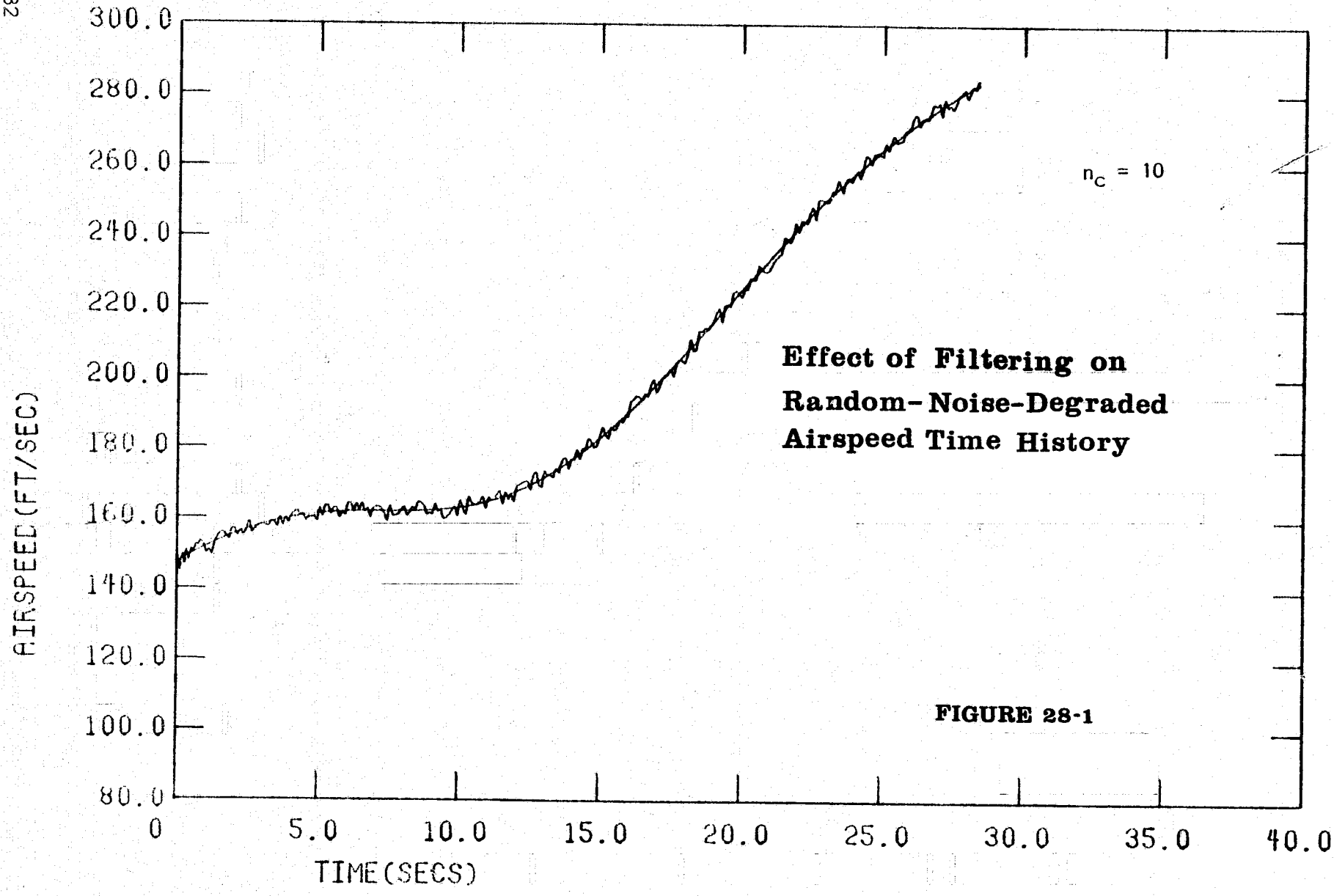
$P_3 =$ -3.02442

$C_{D_0} =$ 0.02777

$C_{D_2} =$ 1.34561

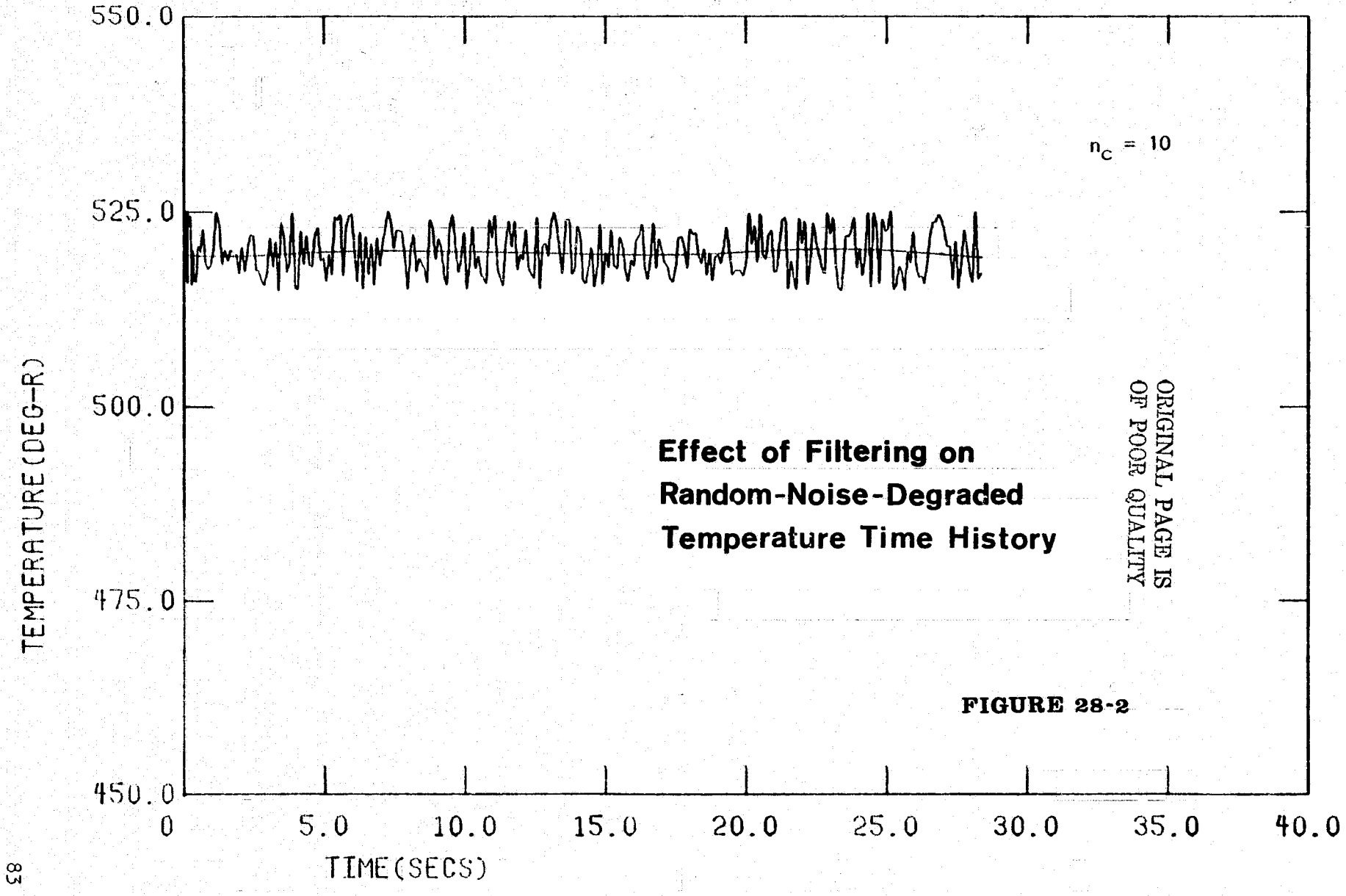
$C_{D_4} =$ 1985.15652

TABLE IV



Effect of Filtering on Random-Noise-Degraded Airspeed Time History

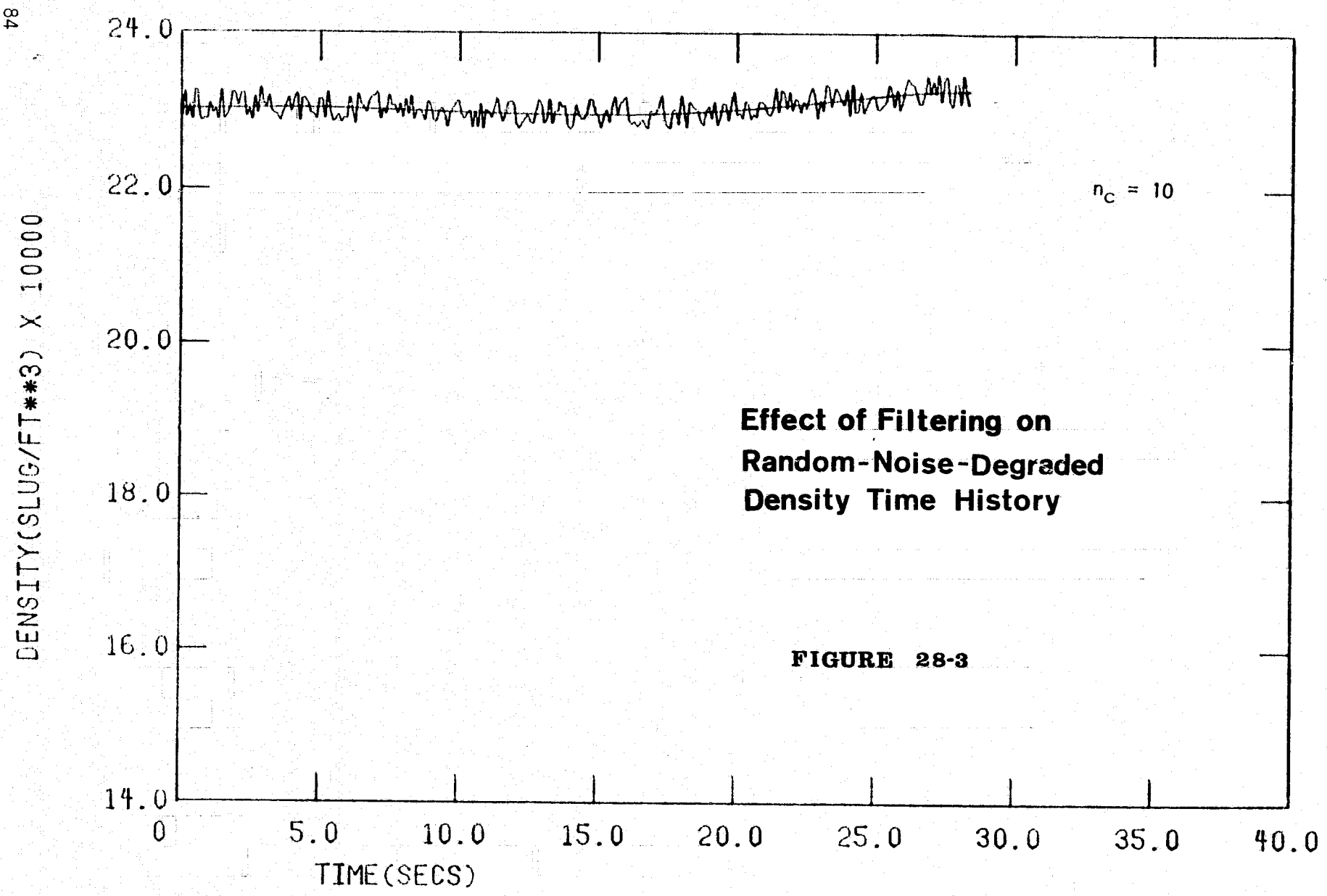
FIGURE 28-1



Effect of Filtering on Random-Noise-Degraded Temperature Time History

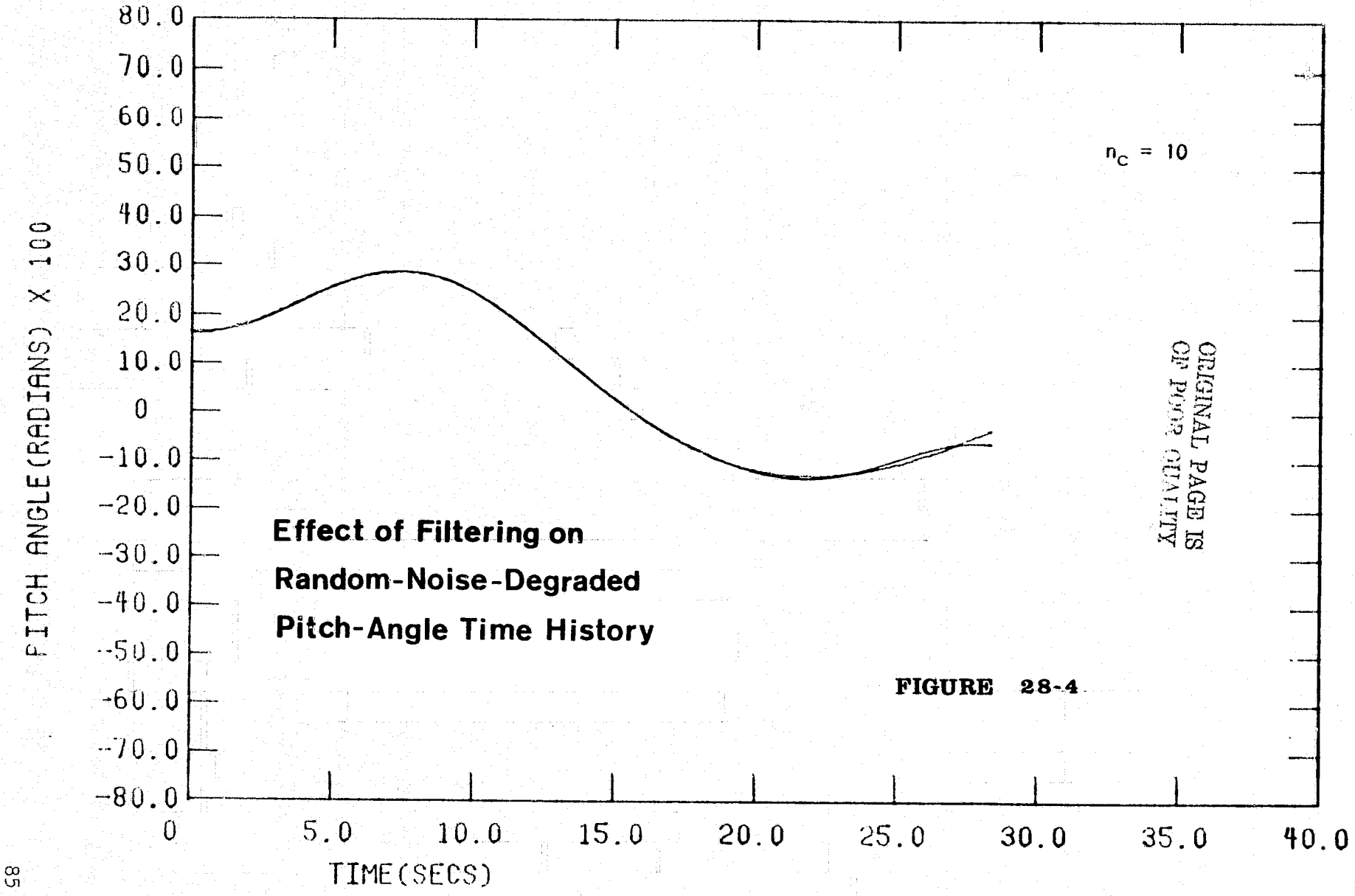
FIGURE 28-2

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Effect of Filtering on Random-Noise-Degraded Density Time History

FIGURE 28-3



Effect of Filtering on Random-Noise-Degraded Pitch-Angle Time History

FIGURE 28-4

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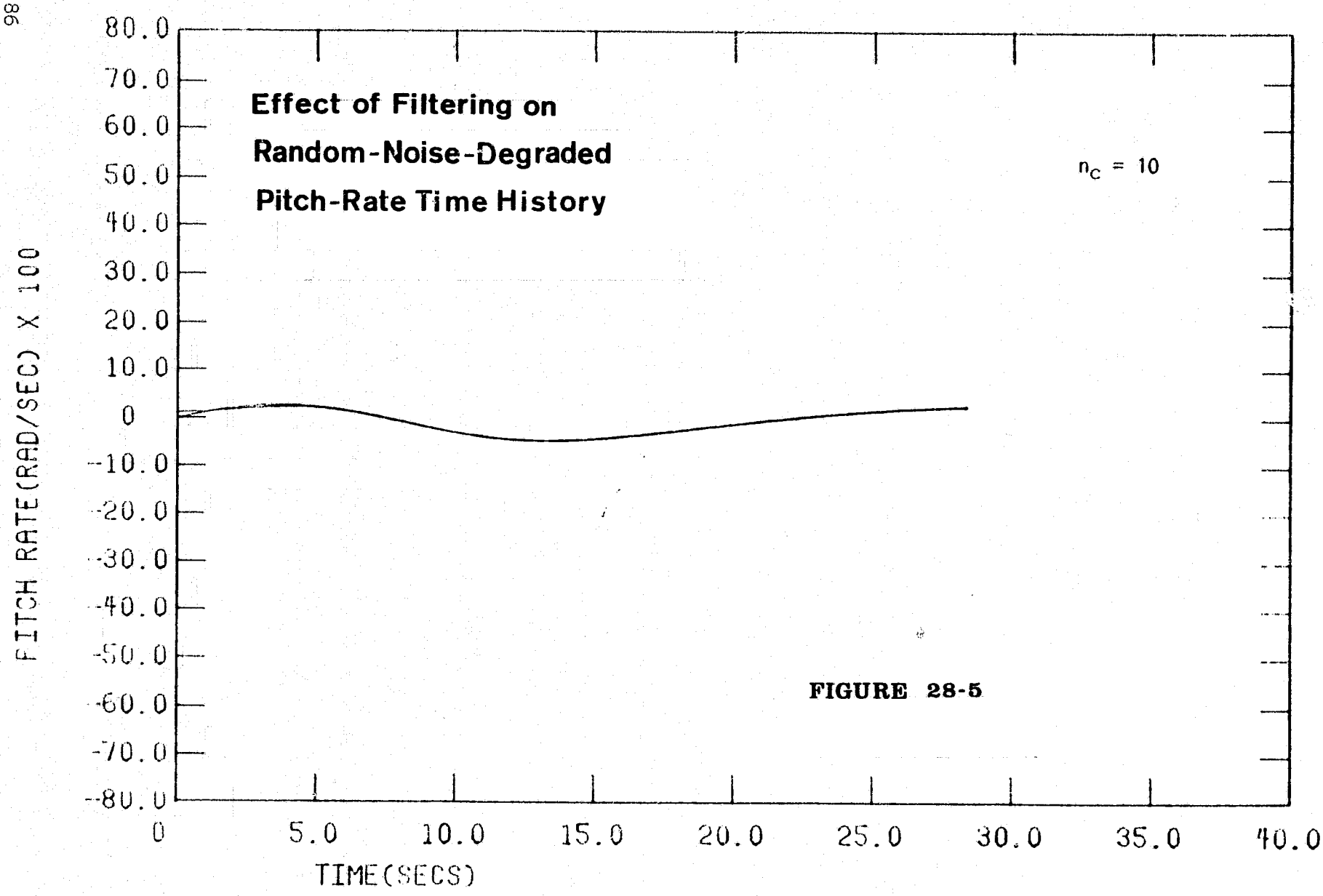

Effect of Filtering on
Random-Noise-Degraded
Pitch-Rate Time History
n_c = 10
PITCH RATE(RAD/SEC) X 100
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 28-5

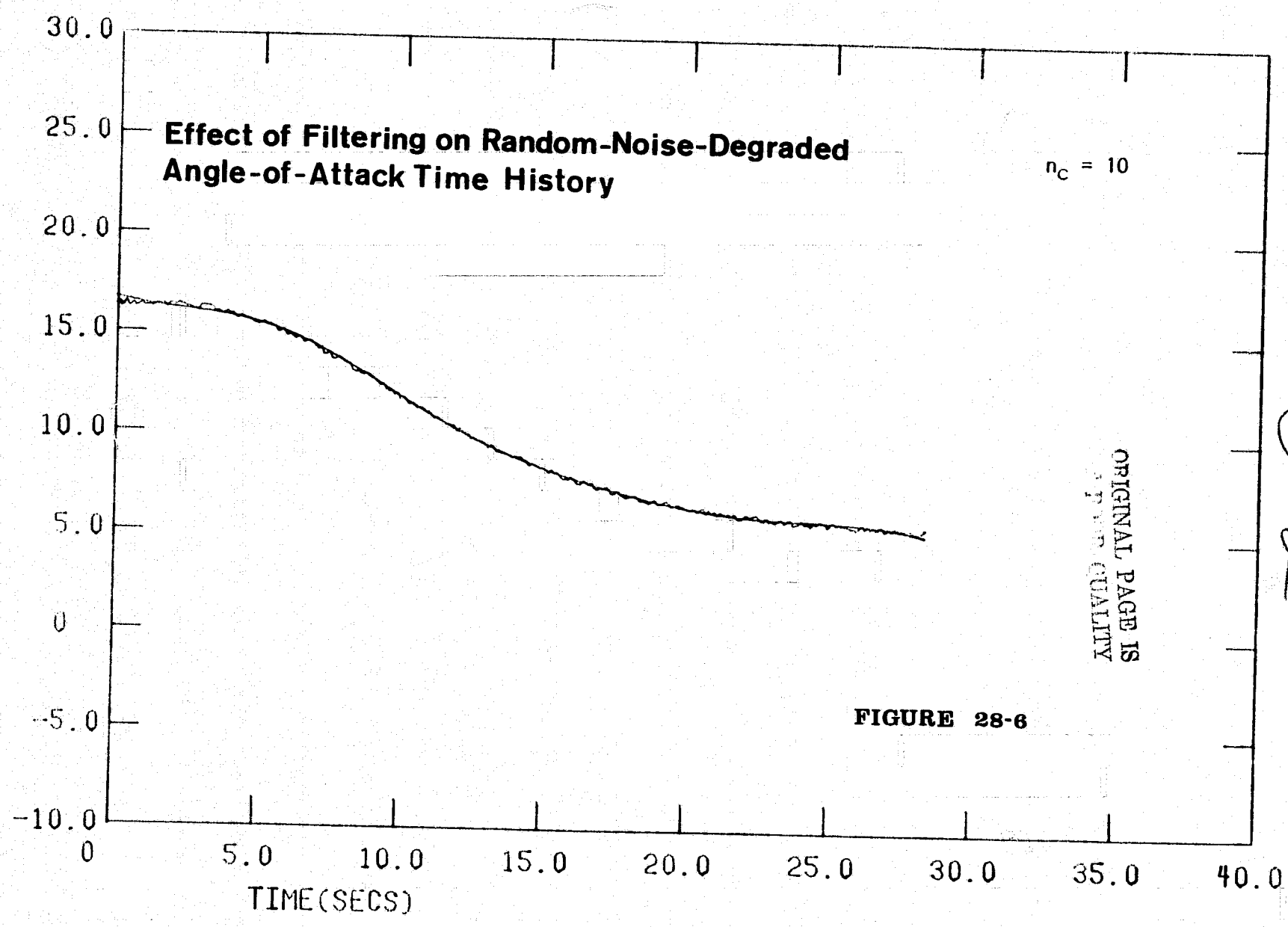


FIGURE 28-6

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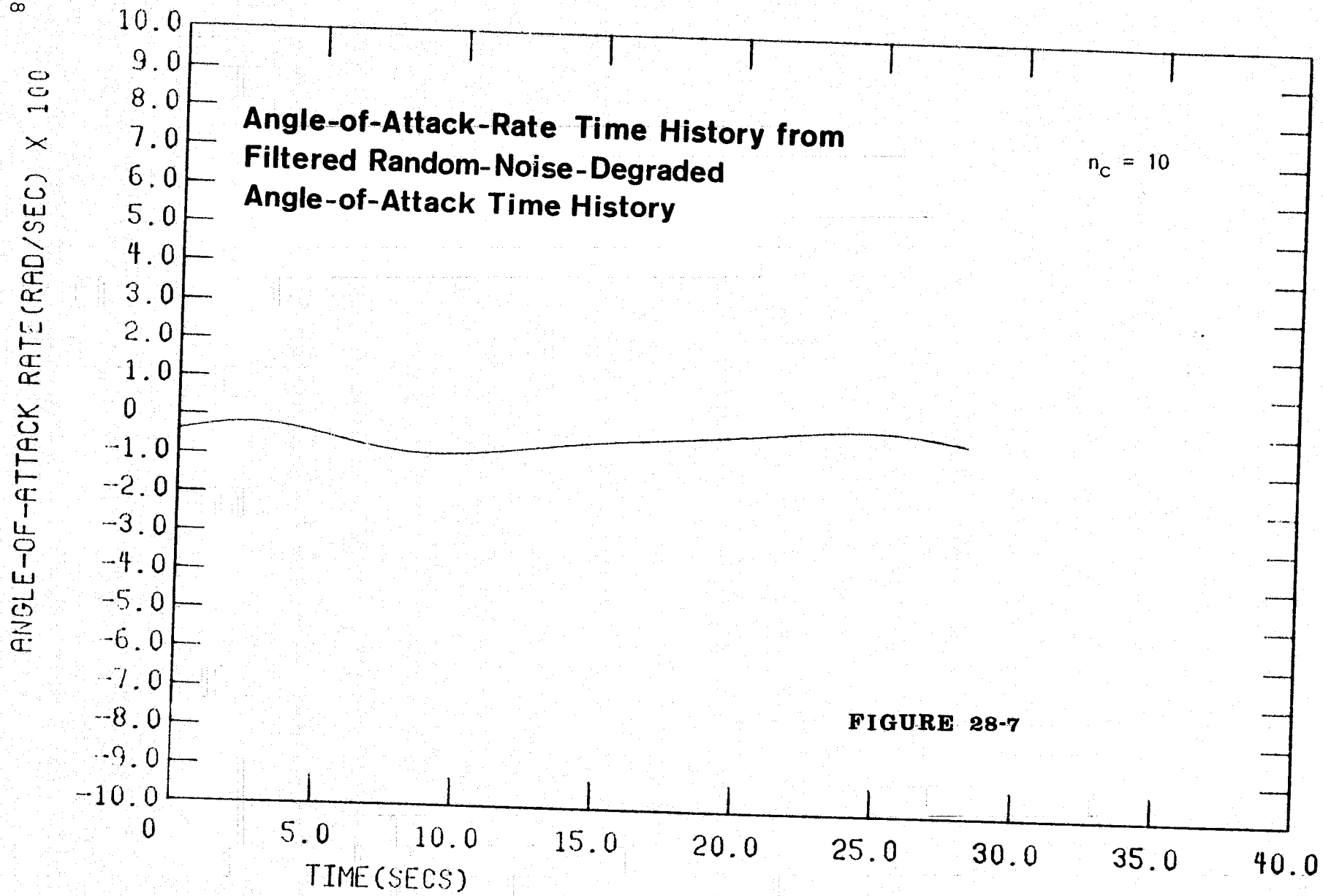

Angle-of-Attack-Rate Time History from
Filtered Random-Noise-Degraded
Angle-of-Attack Time History
n_c = 10
ANGLE-OF-ATTACK RATE(RAD/SEC) X 100
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 28-7

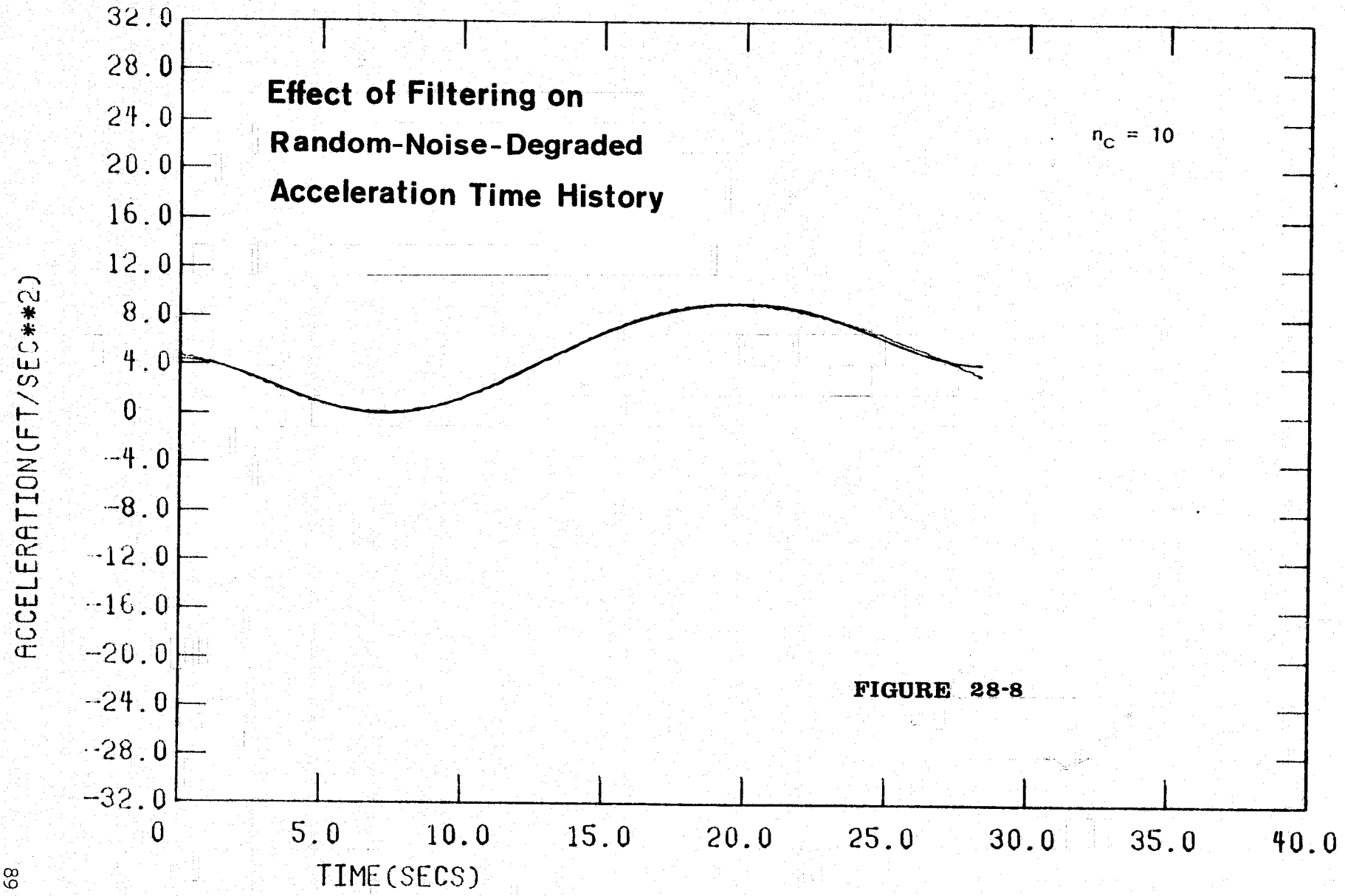

Effect of Filtering on
Random-Noise-Degraded
Acceleration Time History
n_c = 10
ACCELERATION(FT/SEC**2)
32.0
28.0
24.0
20.0
16.0
12.0
8.0
4.0
0
-4.0
-8.0
-12.0
-16.0
-20.0
-24.0
-28.0
-32.0
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 28-8

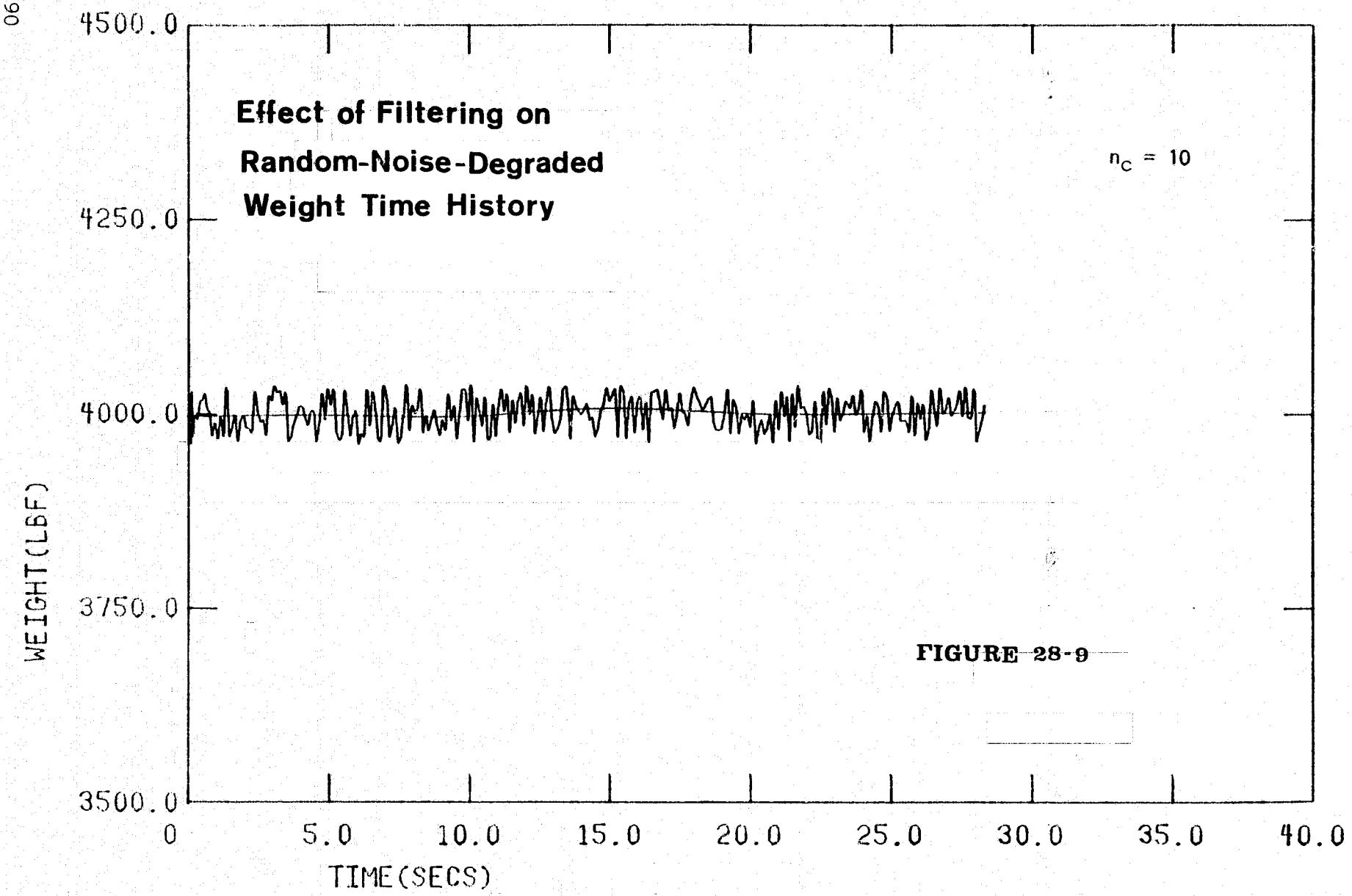

Effect of Filtering on
Random-Noise-Degraded
Weight Time History
n_c = 10
4500.0
4250.0
4000.0
3750.0
3500.0
WEIGHT(LBF)
0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
TIME(SECS)

FIGURE 28-9

A second experiment degraded the data traces individually by a constant bias error. Reproduced as figures 29 through 38 are the recovered speed-power and drag-alpha characteristics for various bias errors compared with the undegraded characteristics used to generate the data traces. Generally, the characteristics for the largest bias error which can yield reasonable results are shown along with the characteristics for smaller bias errors so that the reader may assess the linearity of the change in characteristics with the change in bias error. Note that weight and altitude bias errors of the magnitude shown are not particularly serious. As might be expected, bias errors in airspeed affect the power determination primarily and have little influence on drag. The same is true with regard to bias errors in $\dot{V}$. Bias errors in θ and α, however, are extremely destructive. Even a 0.7° error in θ results in about a 10% error in C_{D_0} while a - 1.9° error in θ results in an error of about 37% in C_{D_0}. The case for a bias error of + 1.9° failed (i.e., gave a power exceeding the limit of 400 H.P.). An angle of attack bias error of as little as 0.1° is noticeable in the final result while an α bias error of 1.6° results in drag and power errors in the neighborhood of 30-40%. In addition, the shapes of the curves are altered drastically.

These results demonstrate the extreme sensitivity of the coefficient extraction procedure to typical noise and instrument errors encountered in flight test work. This is true even after the data have been filtered to remove the noise components which occur at frequencies above the usual aircraft responses to control deflections. Thus, to obtain accurate drag and power data using this procedure some means must be employed to reduce the noise components in the data at what might be termed signal frequencies.

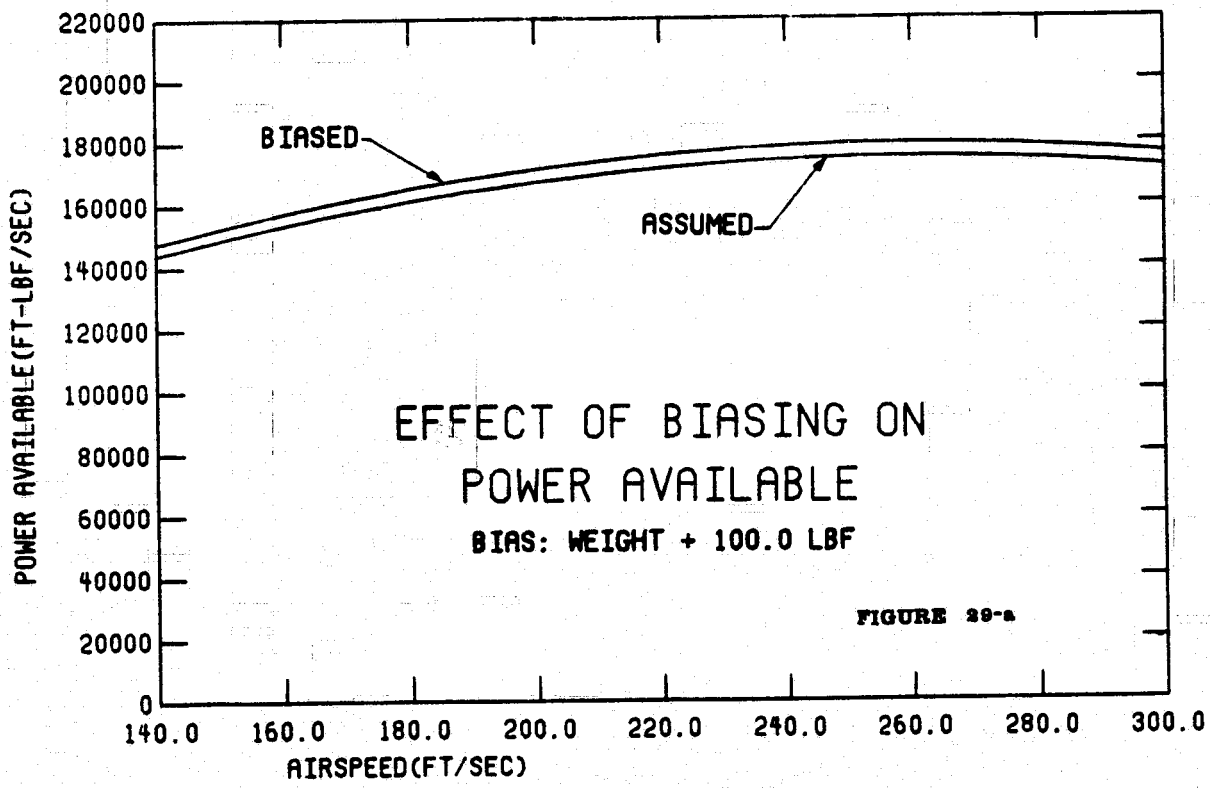


FIGURE 29-a

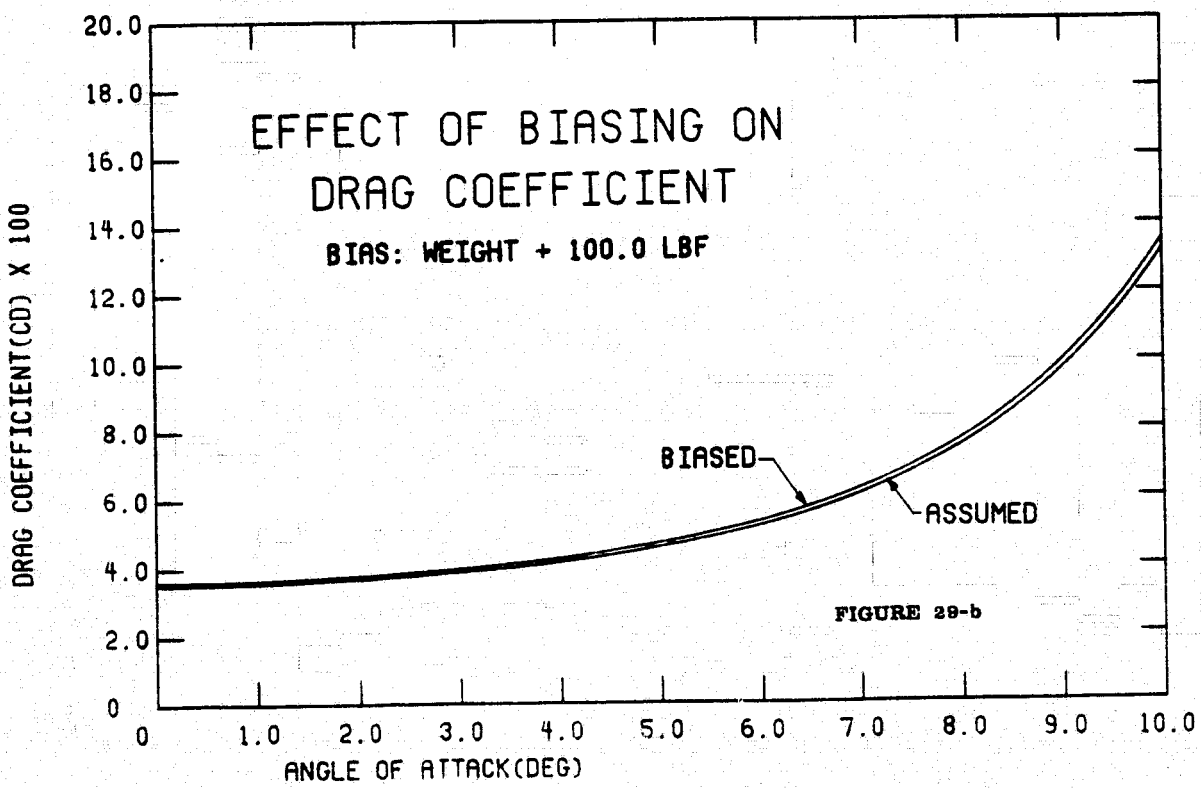


FIGURE 29-b

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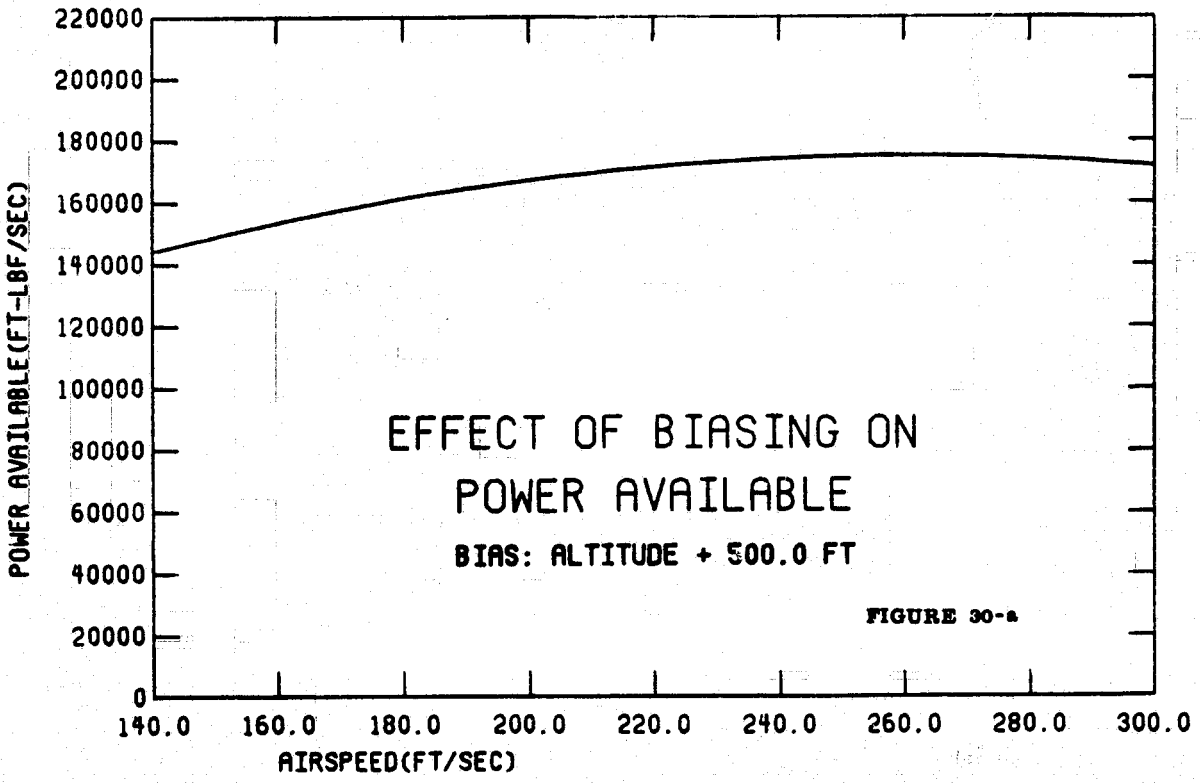


FIGURE 30-a

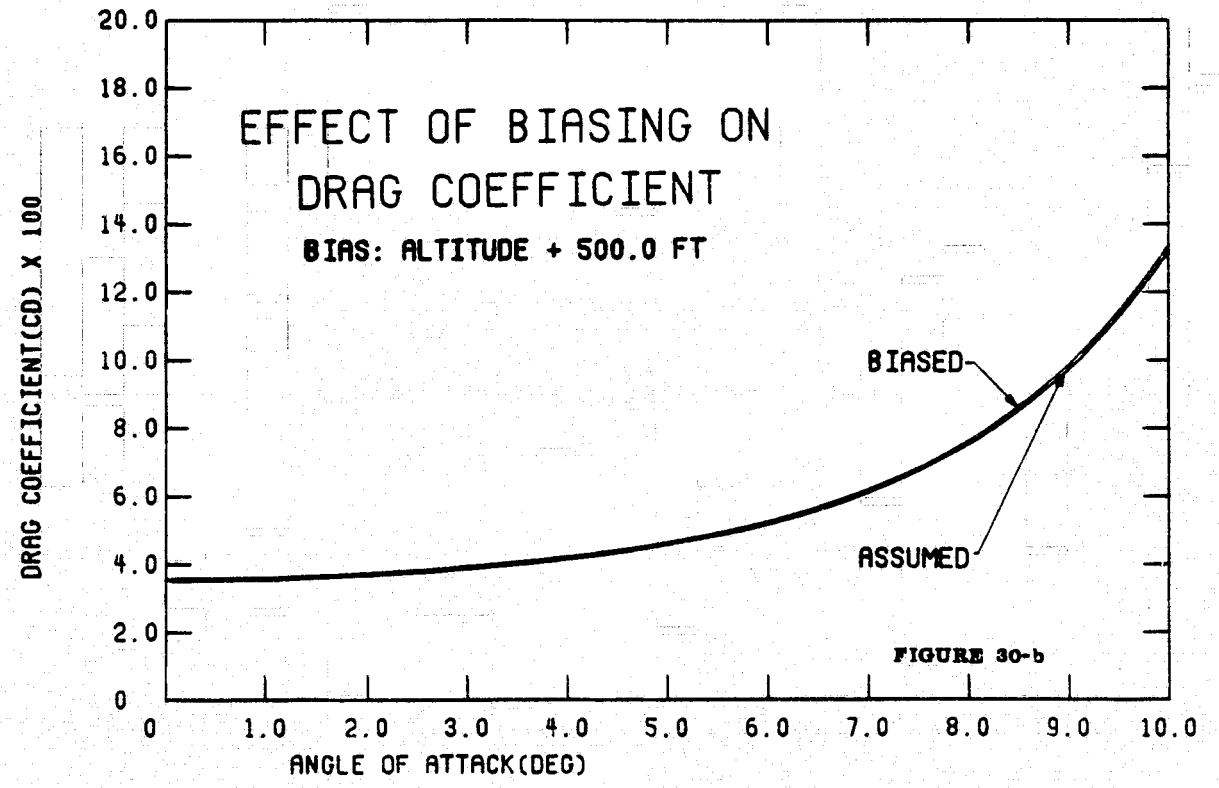


FIGURE 30-b

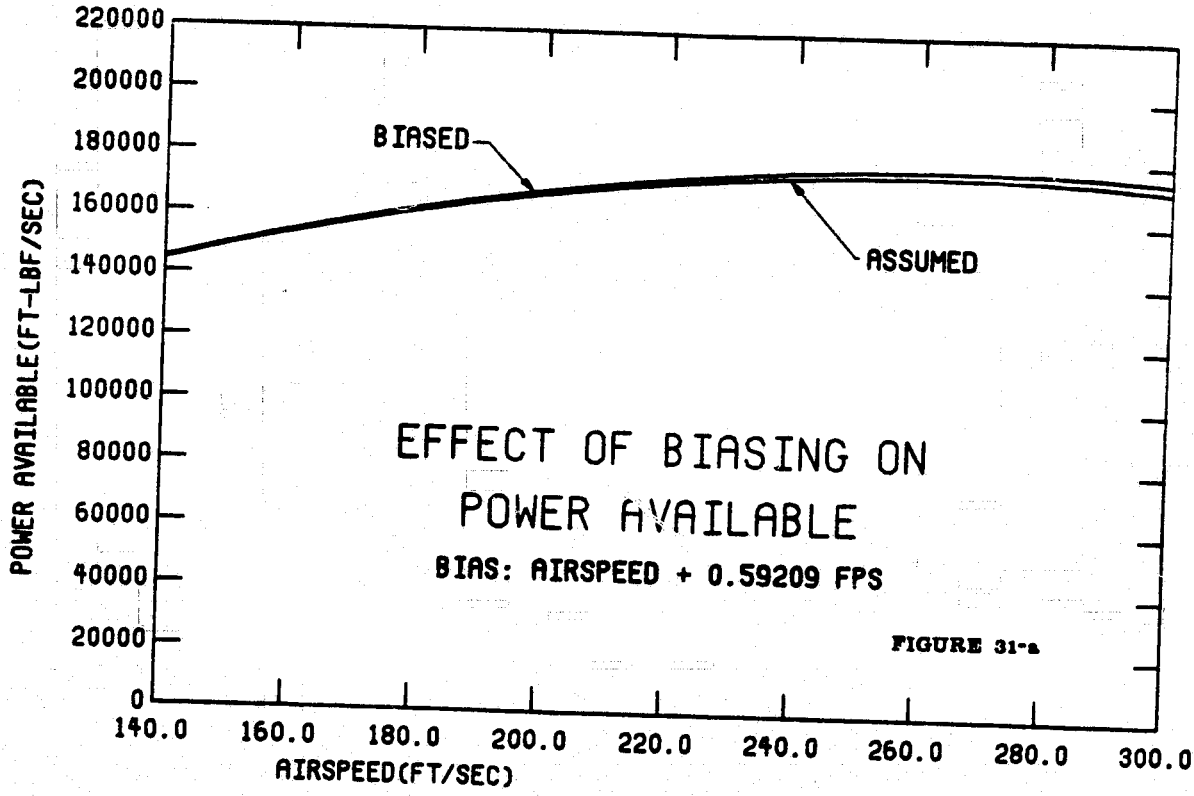


FIGURE 31-a

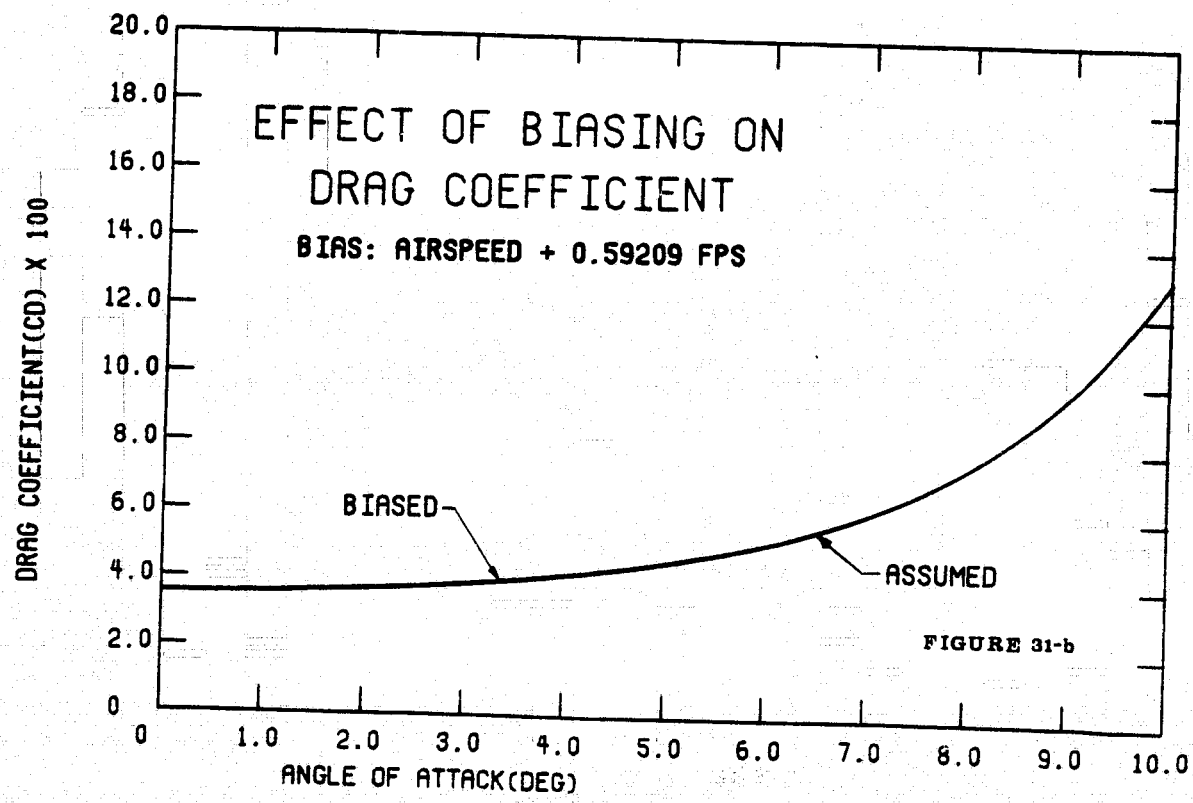


FIGURE 31-b

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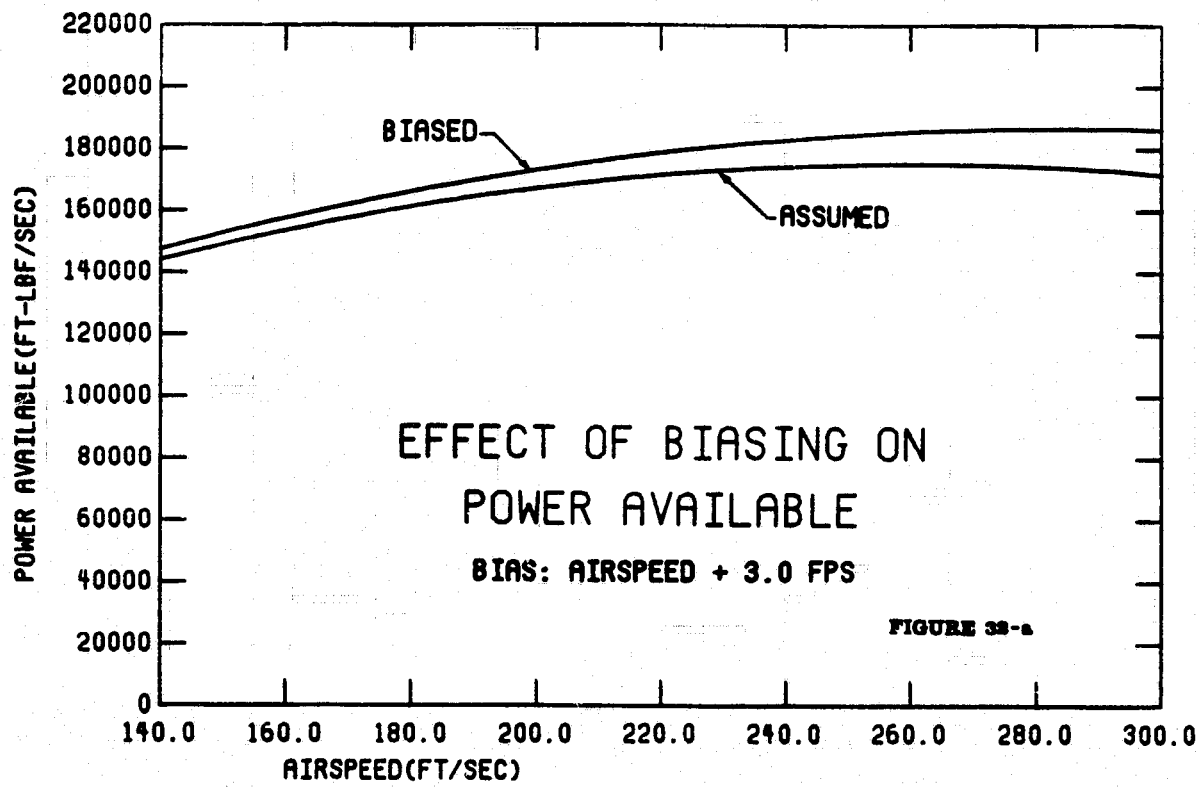


FIGURE 32-a

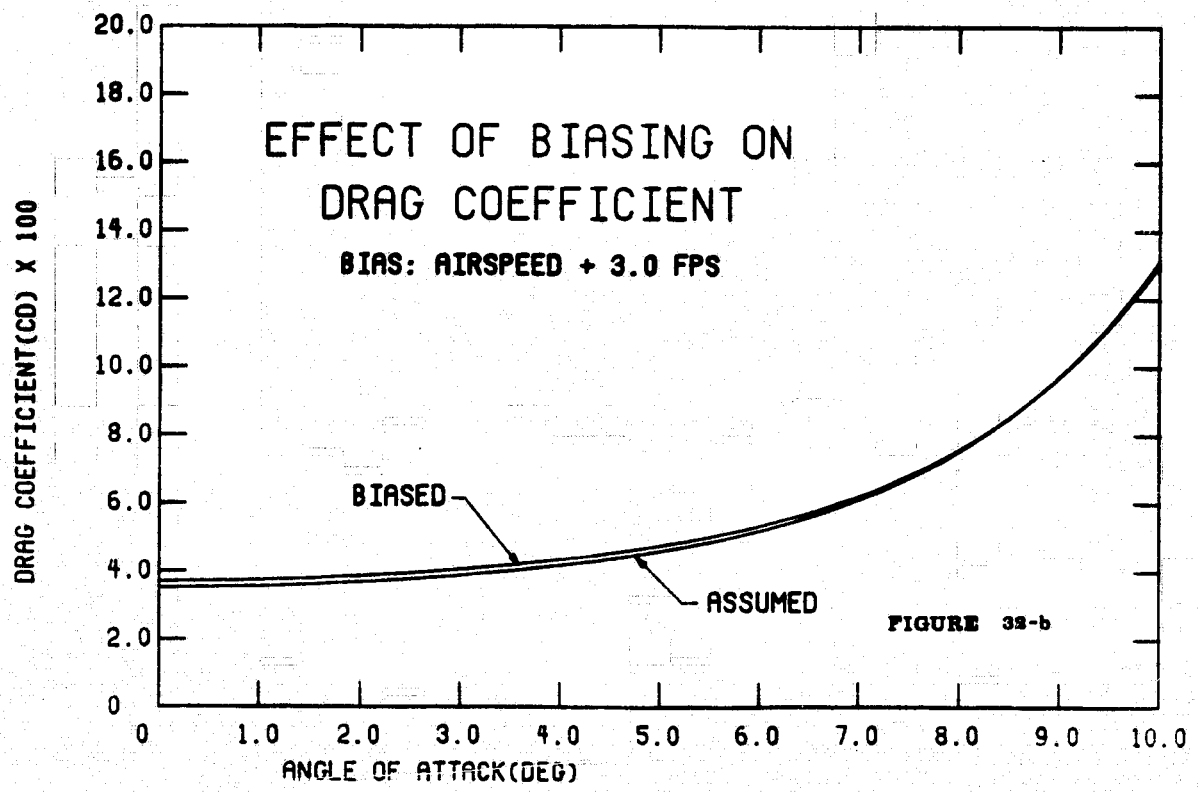


FIGURE 32-b

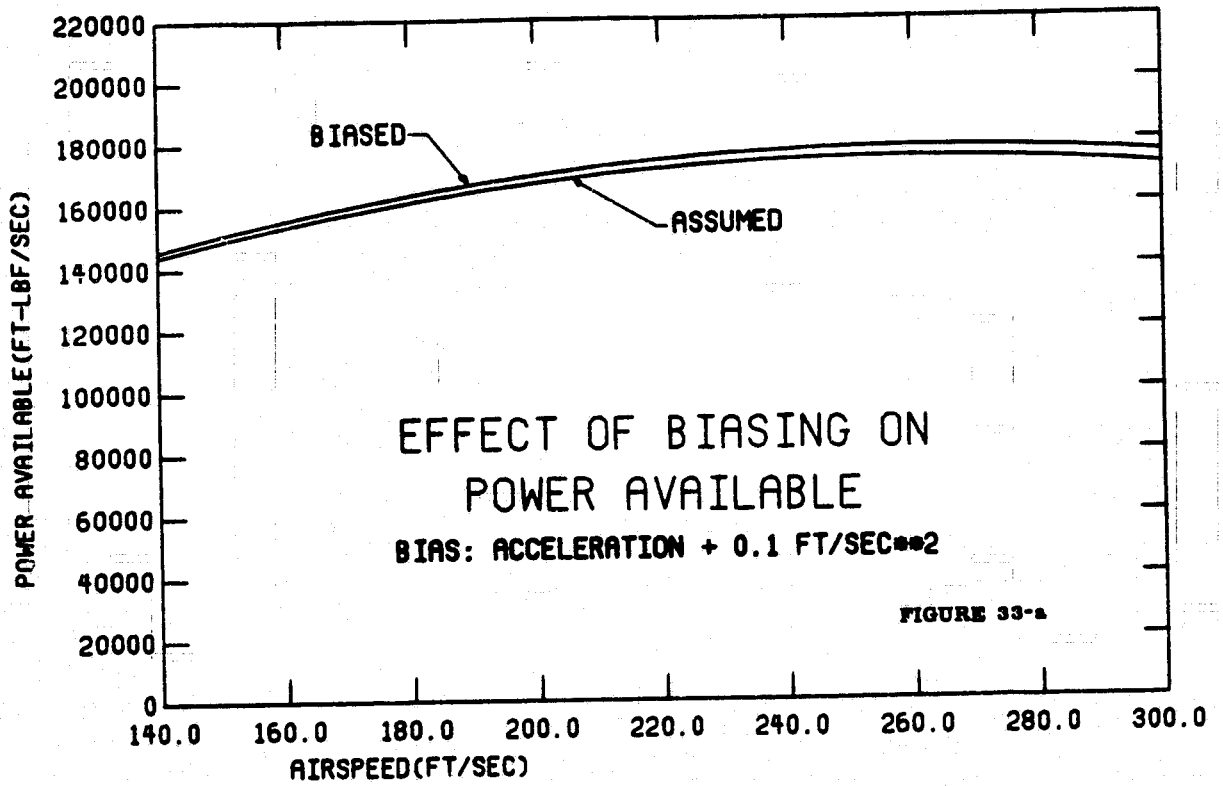


FIGURE 33-a

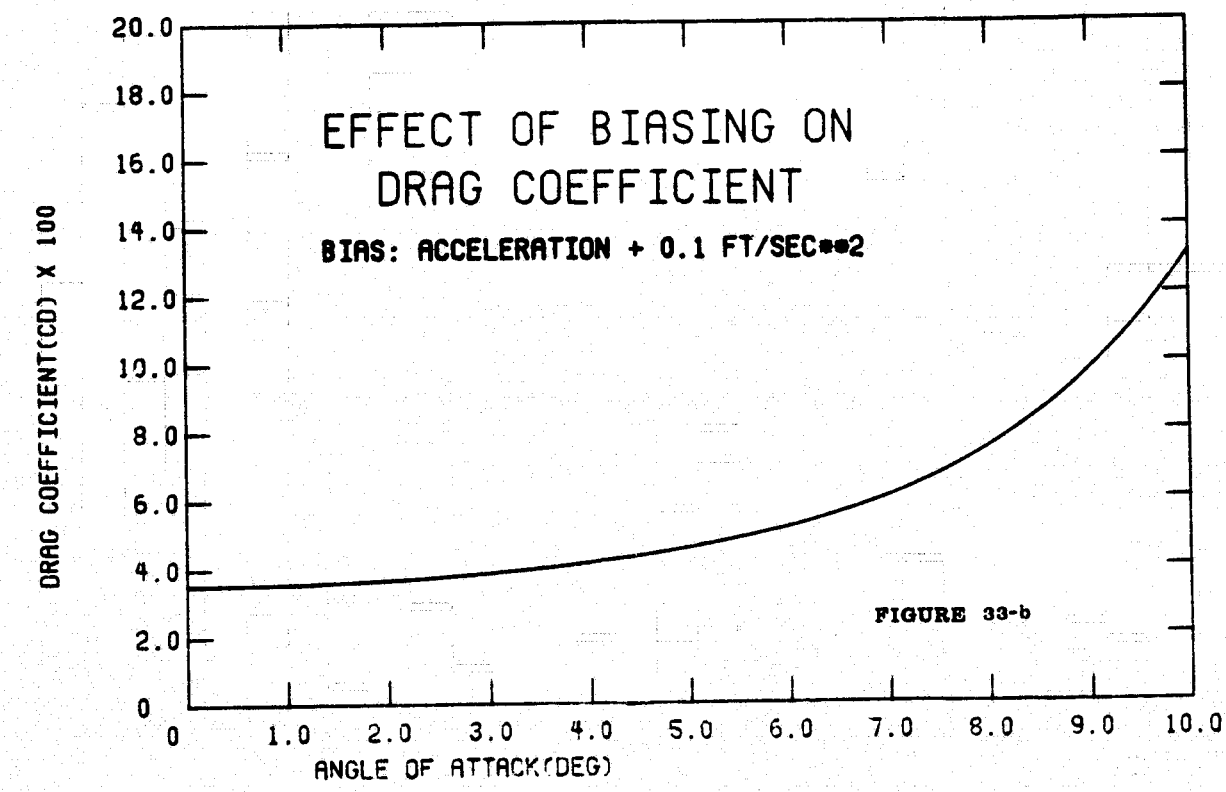


FIGURE 33-b

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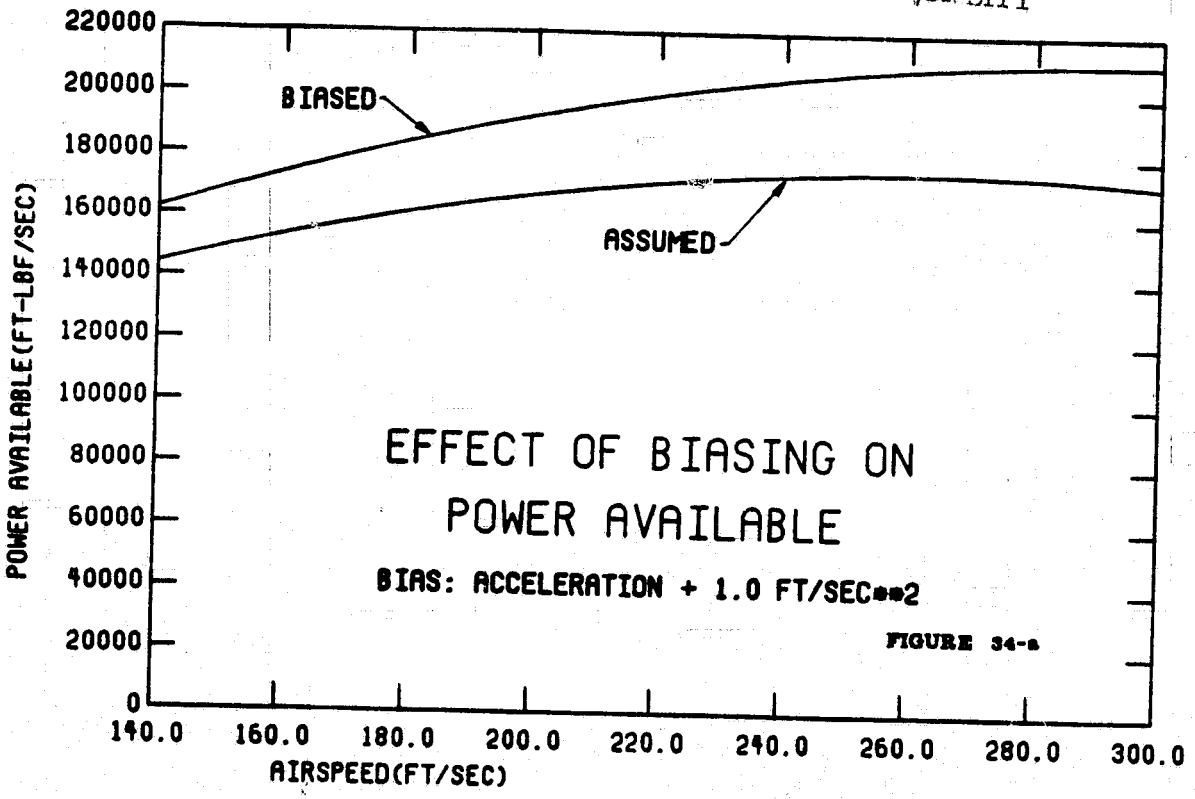


FIGURE 34-a

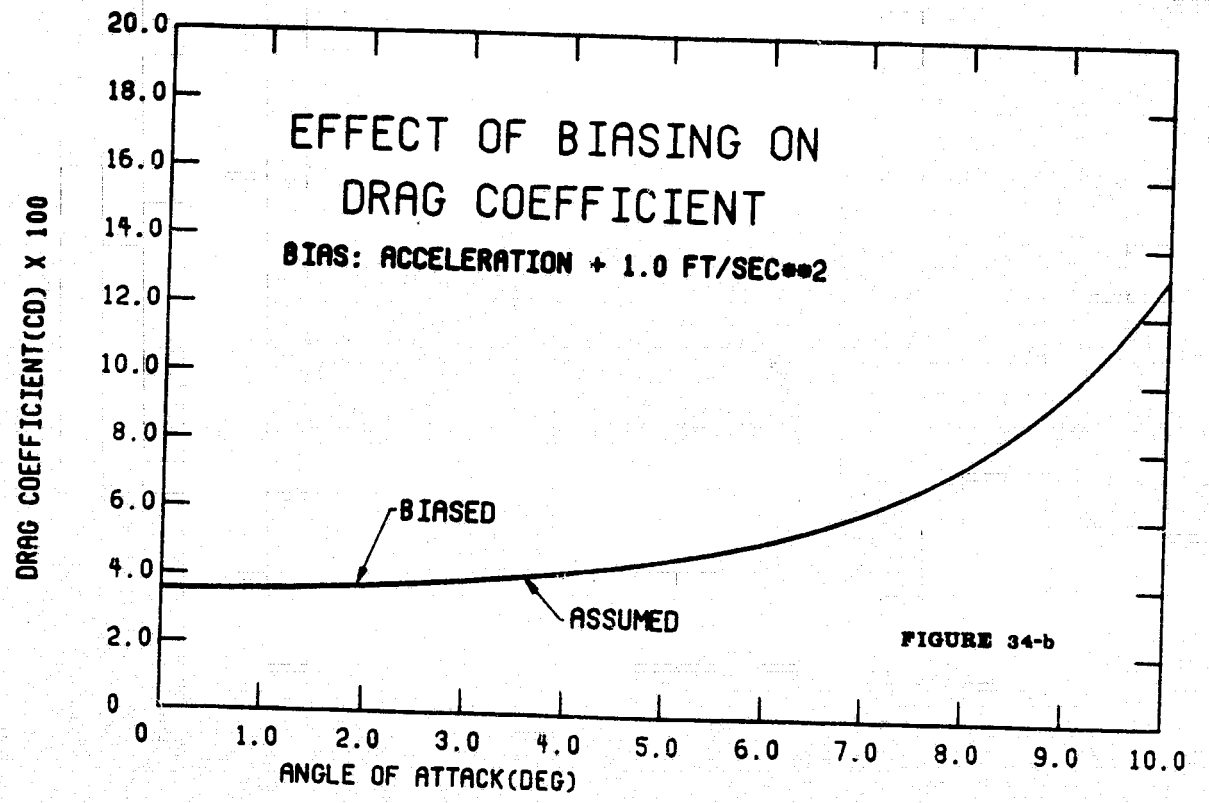


FIGURE 34-b

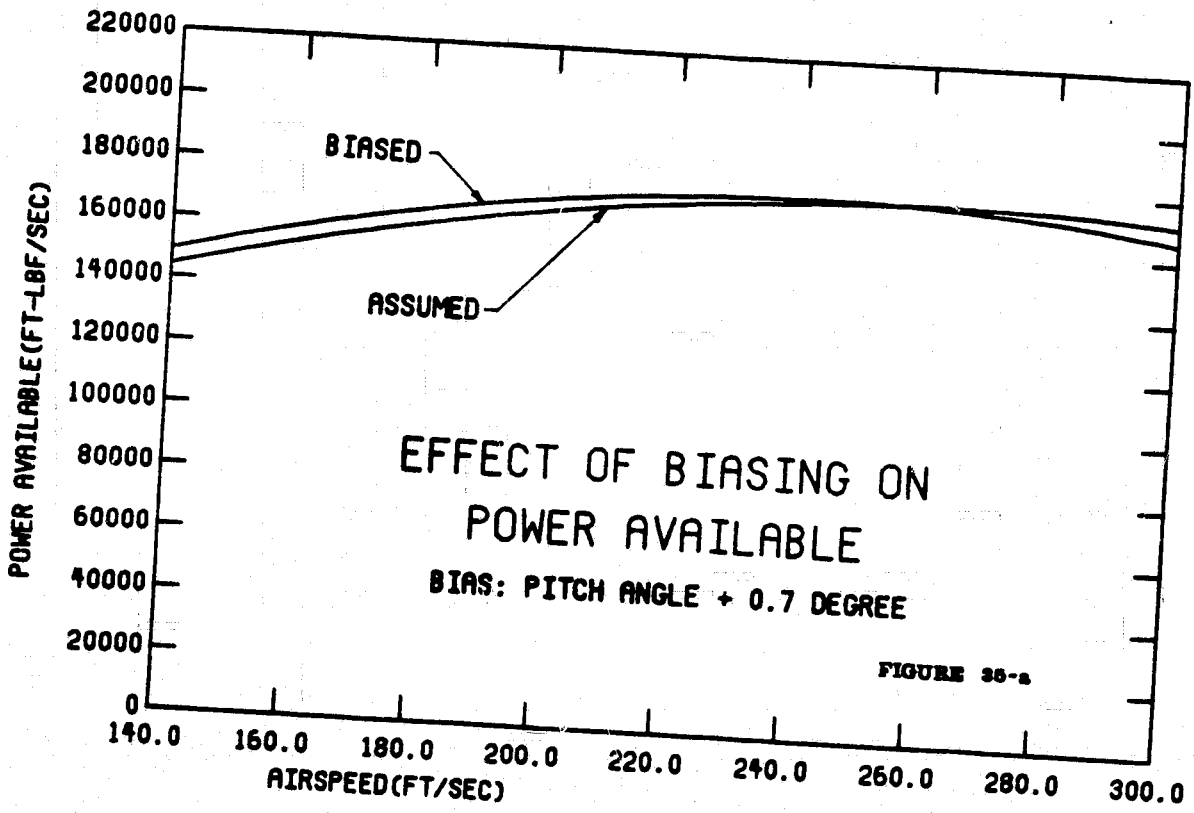


FIGURE 35-a

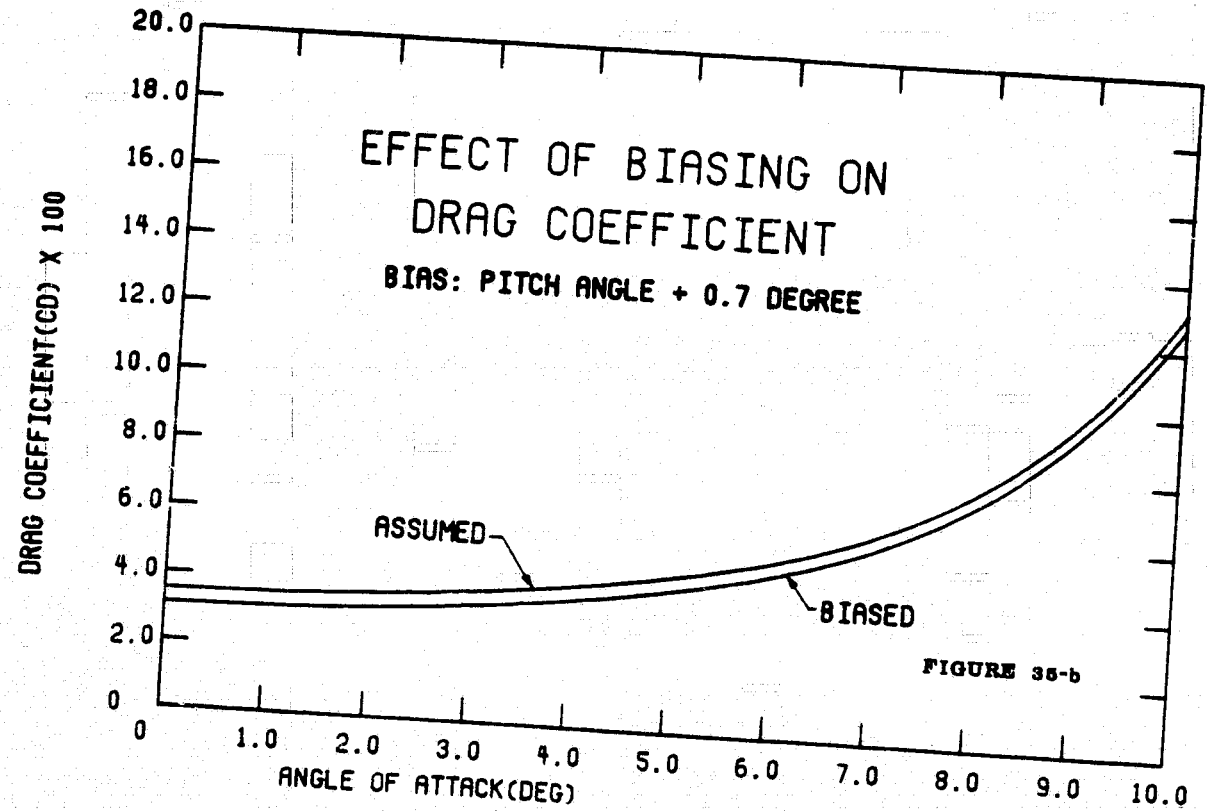


FIGURE 35-b

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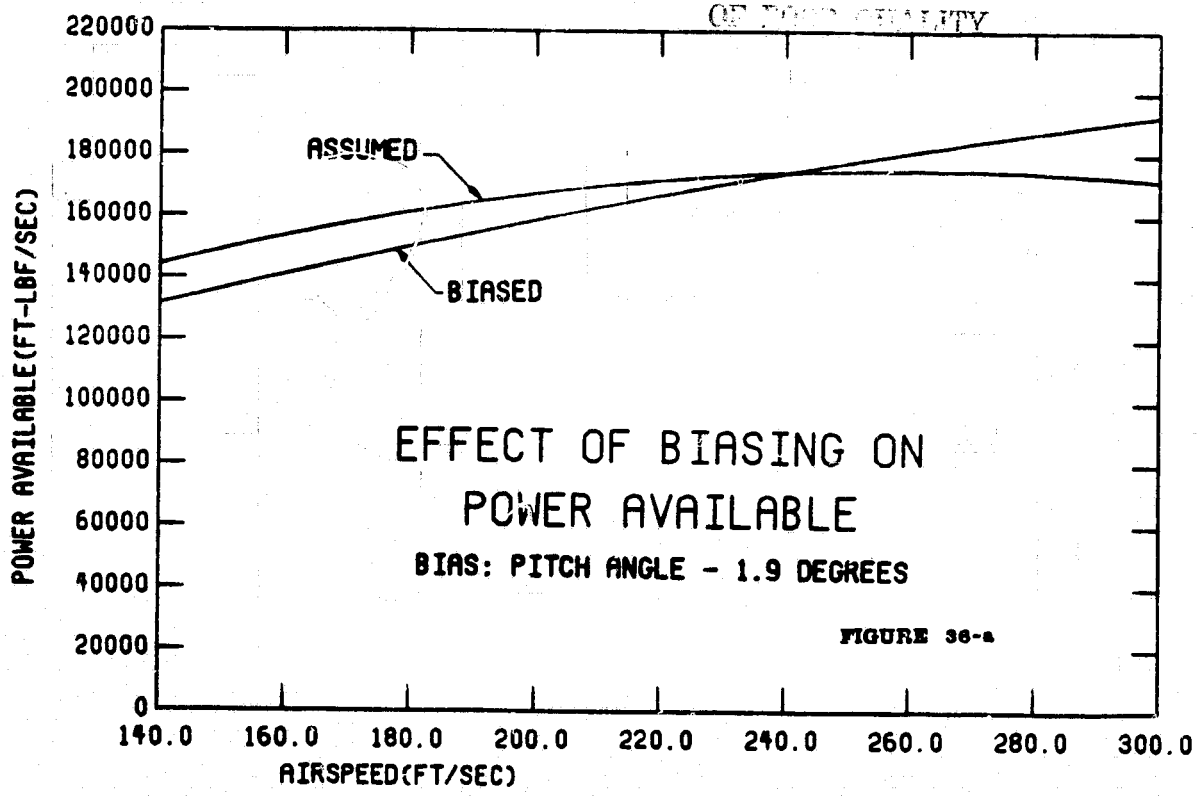


FIGURE 36-a

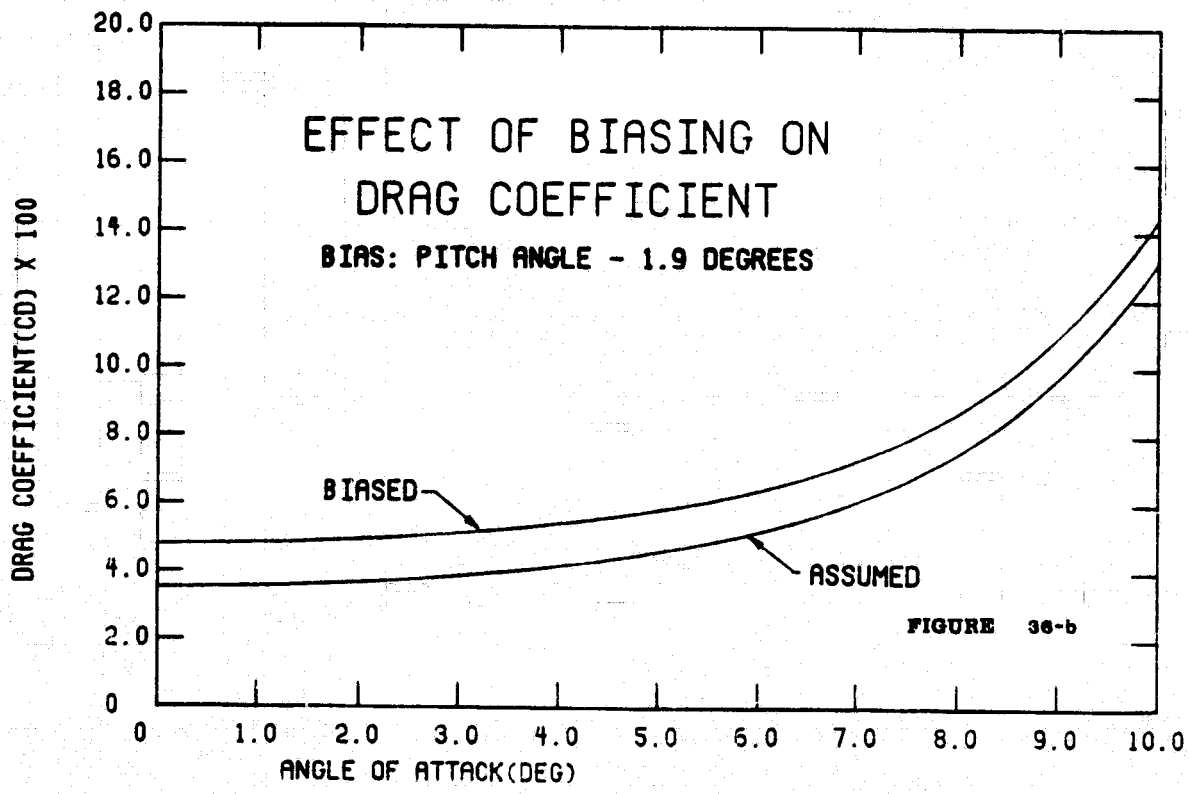


FIGURE 36-b

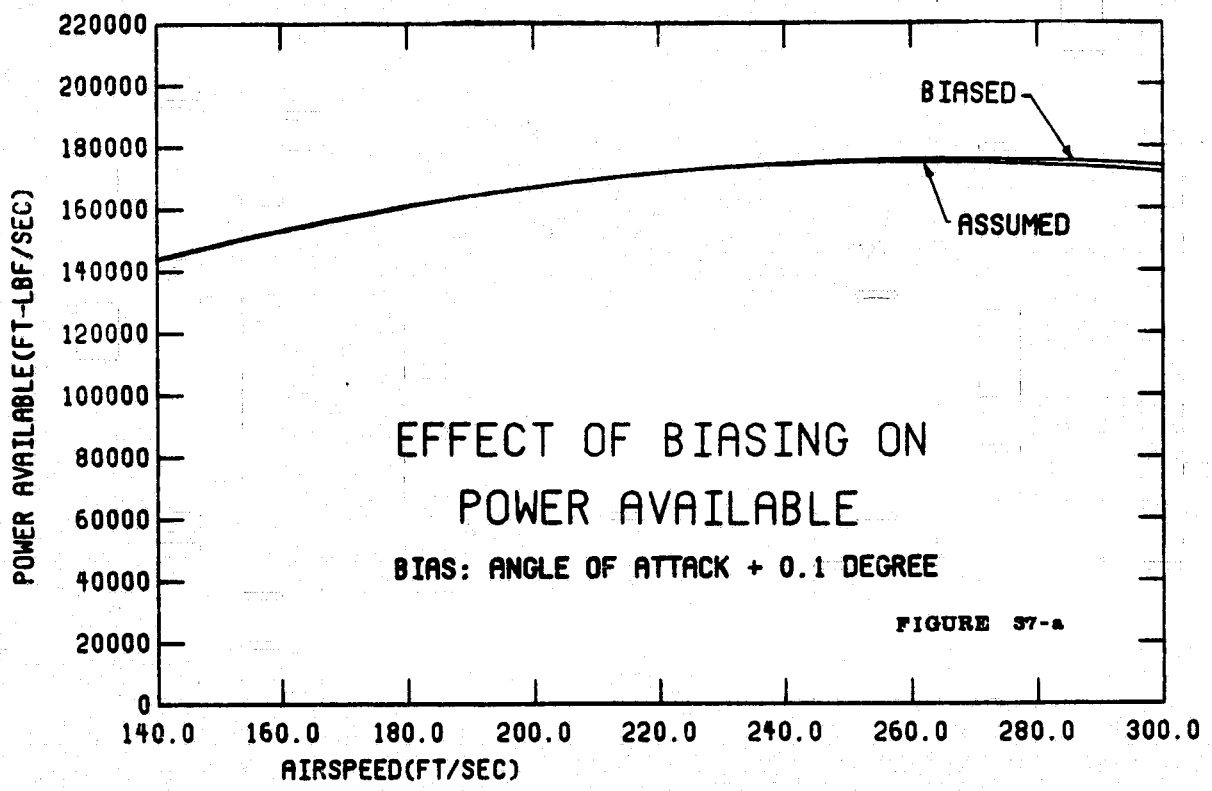


FIGURE 37-a

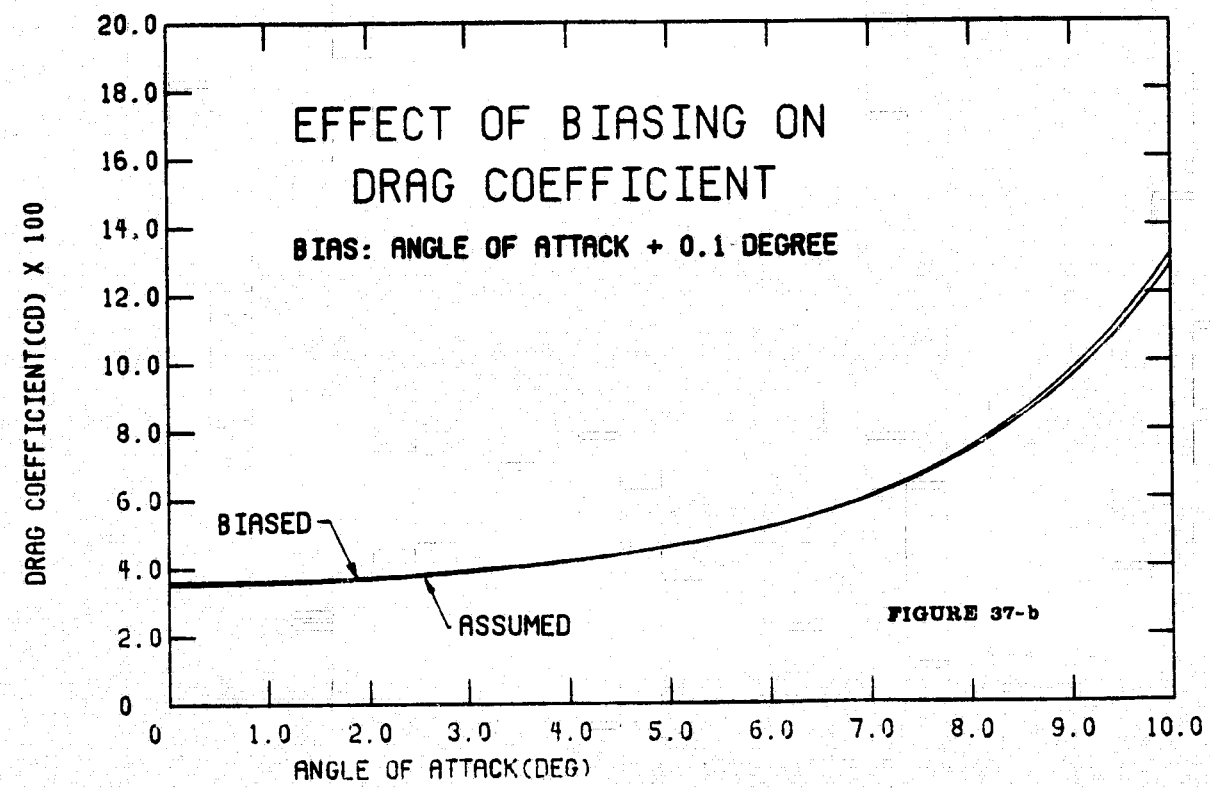


FIGURE 37-b

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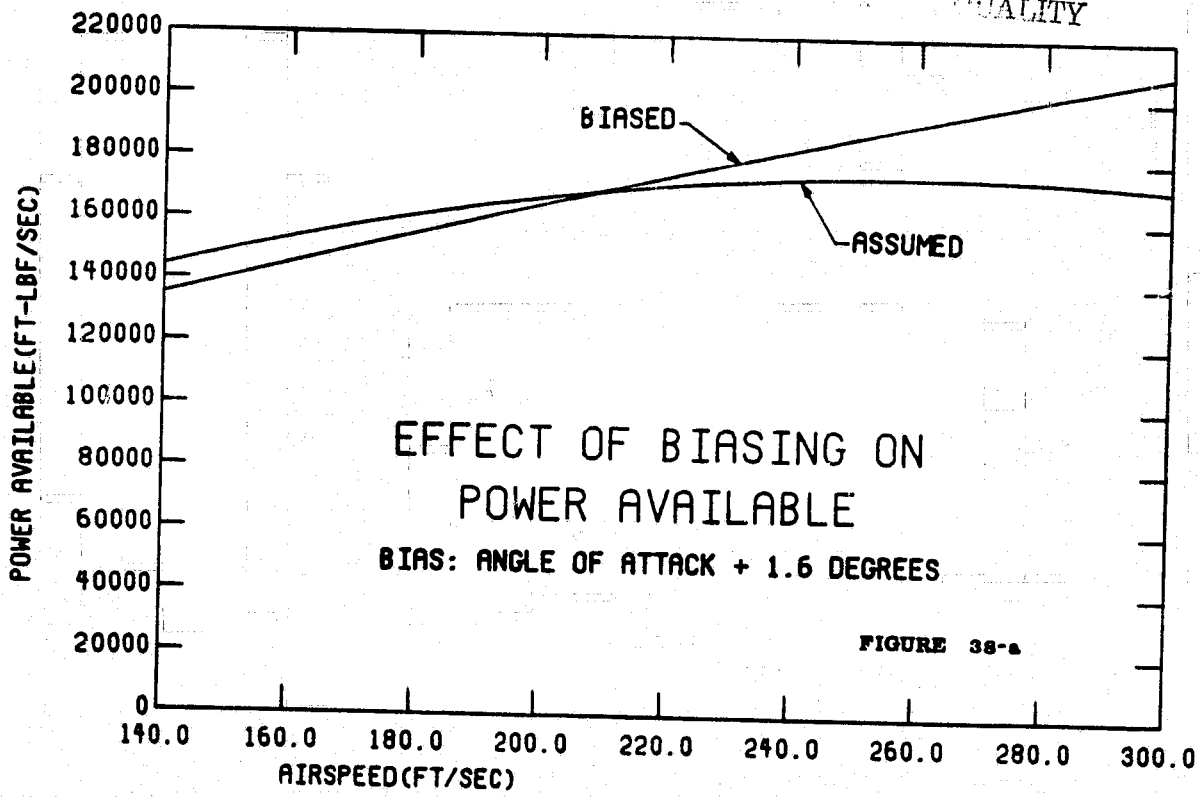


FIGURE 38-a

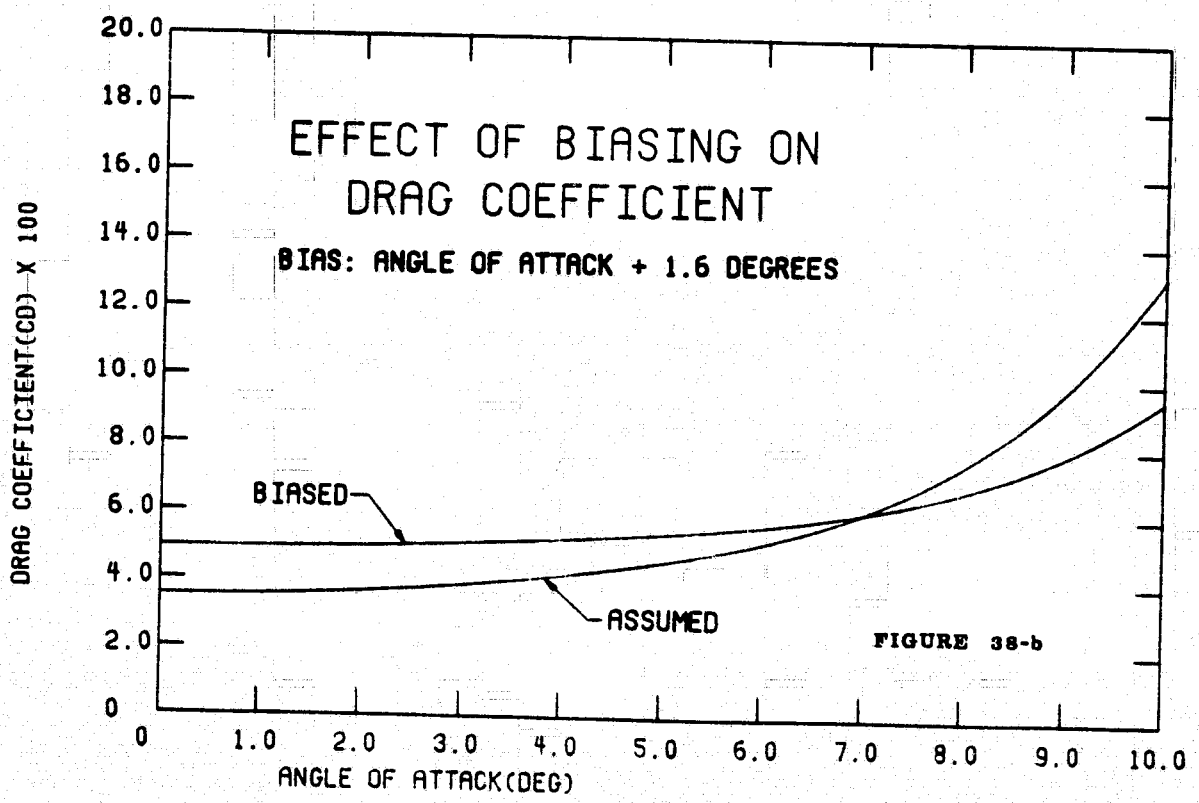


FIGURE 38-b

Reduction of Noise at Signal Frequencies

The filtering technique discussed previously has been shown to be highly effective at suppressing noise components in the data at frequencies above the principal components of the aircraft response. There may, however, still be spurious contributions to the filtered signal from instrument biases, changes in instrument gains, and atmospheric turbulence at frequencies below this cutoff value. These contributions cannot be removed without employing additional information about the system. Since we do not know precisely the nature of these contributions, we will make some assumptions, based on our knowledge of the physics of the situation, to provide the required additional information. If we do this properly, we should be able to improve on the results produced by error-reduction techniques which assume the "noise" in each data channel to be "white" with a zero mean.

For reasons which will become evident later, we will assume that the filtered altitude and velocity data are correct as they stand. The other channels (α, θ, W, a_x, and $\dot{\theta}$), we can be reasonably confident, contain bias, gain, and various types of frequency-dependent errors to some degree.

In order to extract the coefficients of the power and drag models successfully, we have shown that we must have self-consistent data on which to operate. If any data channel contains spurious information, this severely limits our ability to extract the correct model with reasonable coefficient values. Thus, it is important that we take steps to assure, at the least, that our data set is self-consistent. We will therefore adopt a policy of modifying the filtered measured α, θ, and W data so that they form a consistent set with V and h. So long as these modifications are not excessive, say greater than 1% of the maximum data values, we can justify our changes by saying that the altered values still lie within the normal error bounds of the data*.

1. Reduction of Bias Error in α

We seek to modify α initially in order to remove significant bias errors. To this end we write equation (6) in the form

---

*This is a somewhat different approach from those usually used to counter the extreme sensitivity of the least squares estimator to noisy data. Most investigators employ different, less sensitive identifiers (e.g., Newton-Raphson Maximum Likelihood, Gram, Kalman Filter, etc.) which may include provisions for treating certain types of random noise, but they do not modify the input data as such. According to a private communication from Dr. G. J. Dobeck of the Naval Coastal Systems Laboratory, Panama City, Florida, the best estimator for a particular problem depends upon the problem. Since the present problem is rather different from those usually described in the literature, it is not surprising that the more common procedures are not readily adapted to it. For the reader with a good mathematical background interested in a comparison of the characteristics of several of these identifiers, Dr. Dobeck's Ph.D. thesis at the University of South Florida, "System Identification and Application to Undersea Vehicles", is recommended.

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$$S = \sum_{i=1}^{N}\left[\frac{W_i \dot{V}_i}{g} + W_i \sin(\theta_i - \alpha_i) - W_i \Delta\alpha \cos(\theta_i - \alpha_i) - \left(\frac{P_o}{V_i} + P_1 + P_2 V_1\right)\cos\alpha_i + \Delta\alpha \sin\alpha_i\left(\frac{P_o}{V_i} + P_1 + P_2 V_i\right) + \frac{\rho_i S V_i^2}{2}\left(C_{D_o} + C_{D_1}\alpha_i^2 + C_{D_2}\alpha_i^6\right) + \frac{\rho_i S V_i^2}{2}\left(2\alpha_i \Delta\alpha_i C_{D_1} + 6\alpha_i^5 \Delta\alpha_i C_{D_2}\right)\right]^2 \quad (76)$$

where it has been assumed for the purposes of this analysis that $\cos\Delta\alpha = 1$, $\sin\Delta\alpha = \Delta\alpha$, and $(\alpha + \Delta\alpha)^6 = \alpha^6 + 6(\Delta\alpha)a^5$. We then minimize S with respect to $\Delta\alpha$ to yield

$$\Delta\alpha = -\frac{\sum_{i=1}^{N} B_o B_1}{\sum_{i=1}^{N} B_o^2} . \quad (77)$$

Here,

$$B_o = -W_i \cos(\theta_i - \alpha_i) + \sin\alpha_i\left(\frac{P_o}{V_i} + P_1 + P_2 V_i\right) + \frac{\rho_i S V_i^2}{2}\left[2\alpha_i C_{D_1} + 6\alpha_i^5 C_{D_2}\right] \quad (78)$$

and

$$B_1 = \frac{W_i \dot{V}_i}{g} + W_i \sin(\theta_i - \alpha_i) - \left[\frac{P_o}{V_i} + P_1 + P_2 V_1\right]\cos\alpha_i + \frac{\rho_i S V_i^2}{2}\left[C_{D_o} + C_{D_1}\alpha_i^2 + C_{D_2}\alpha_i^6\right] . \quad (79)$$

(This form will be the same for each of the 23 other models used to represent the data, only the values of B_0 and B_1 will be different.) The result of this computation is then the amount which must be added to α in order to minimize the fit error for the particular model employed. Since we are not certain that the model with the lowest fit error using degraded data is the best model when the data have been "treated", we will add only 2/3 of $\Delta\alpha$ to α, before we repeat the extraction process. The result, we then assume, is the smallest fit error which can be obtained by removing a bias from the α data.

2. Establishing the Probable Values of α and the Coefficients of the Lift Equation

Since the equation has been shown to be most sensitive to errors in α, we will endeavor to employ a procedure for establishing the proper range of α values which is not heavily dependent upon the value of α. We begin by choosing to fit the data in a least squares sense with the model

$$P = P_o V^{1/3}$$

$$C_D = C_{D_0} + C_{D_1} \alpha + C_{D_2} \alpha^2 + C_{D_3} \alpha^3 + C_{D_4} \alpha^4 . \qquad (80)$$

This power model was selected on the basis of early full-scale wind tunnel test results as being a reasonably good representation of the actual power into the airstream. We recognize in addition that the equation relating forces and motions normal to the flight path can be written

$$\dot{\gamma} = \frac{gSV}{2W} C_L(\alpha)\, \rho(h) - \frac{g \cos \gamma}{V} + \frac{g P \sin \alpha}{WV^2} , \qquad (81)$$

where $$\rho(h) = \rho_0 (1 - 6.86 \times 10^{-6} h)^{4.26} , \qquad (82)$$

$$\gamma = \sin^{-1}(\dot{h}/V) , \qquad (83)$$

and $$\dot{\gamma} = \frac{1}{\sqrt{1-(\dot{h}/V)^2}} \left[\frac{V\ddot{h} - \dot{h}\dot{V}}{V^2} \right] . \qquad (84)$$

$\dot{h}$ is available as a consequence of the filtering operation and $\ddot{h}$ or, alternately, $\dot{\gamma}$ can be obtained by spline fitting the $\dot{h}$ data or the computed values

of γ. Note that these equations involve only velocity and altitude (which we have already assumed to be noise-free) and their derivatives. In the interests of data consistency we have chosen to ignore the fact for the time being that γ is also $\theta - \alpha$.

Now (81) can be rearranged to represent C_L in the form

$$C_L = \frac{2W}{g \rho SV^2} \left[\dot{\gamma} + \frac{g \cos \gamma}{V} - \frac{g P \sin \alpha}{WV^2} \right] . \qquad (85)$$

We know also that a reasonably accurate representation of the drag coefficient is

$$C_D = \overline{C}_{D_o} + \overline{C}_{D_1} C_L + \overline{C}_{D_2} C_L^2 . \qquad (86)$$

With this representation we will write equation (6) as

$$\frac{\dot{V}}{g} + \sin \gamma = \frac{\overline{P}_0 V^{1/3}}{WV} \cos \alpha - \frac{\rho SV^2}{2W} (C_{D_1} + C_{D_1} C_L + \overline{C}_{D_2} C_L^2) . \qquad (87)$$

With the power values obtained from (80) we solve for $C_L(t)$ from (85). Given these values, we find $\overline{P}_0$, $\overline{C}_{D_o}$, $\overline{C}_{D_1}$, and $\overline{C}_{D_2}$ from (87) in a least squares sense. Using the value of $\overline{P}_0$ found in this fashion, we reenter (85) and find a new value of $C_L(5)$. This is then used to extract new values of P_0, C_{D_o}, C_{D_1}, and C_{D_2} from (87). The process is repeated until the change in the four coefficients from one iteration to the next is less than 0.001%

As a result of the foregoing, we now have a reasonably reliable picture of $C_L(t)$. This we then fit to the bias-free α-data by a least-squares-distance routine (described in detail in NASA TN D-6374 and also in a later section of this report) using the following model:

$$\{C_{L_i} - CLQ[\dot{\theta}_i]\} = CLAO + CLA[\alpha_i] + CLAX[\alpha_i]^X . \qquad (88)$$

Initially we assume X = 2.0 in order to solve for CLQ by a linear least squares method. With CLQ determined, we subtract the term $CLQ*\dot{\theta}_i$ from C_{L_i} before we apply the least squares distance method to determine new values for the remaining coefficients*. We will assume that CLQ has this same value for the remainder of the data reduction procedures applied to a particular data set. The LSD routine determines the values of coefficients CLAO, CLA, CLAX, and X in this model which minimize the perpendicular distance from the curve represented by (88) to the data points.

We then adjust the values of α at every time point so that they satisfy (88) exactly. We employ for this purpose a second order Newton-Raphson procedure: If we call

$$f(\alpha_{i_k}) = (CLAX)\ \alpha_{i_k}^{X} + (CLA)\ \alpha_{i_k} + CLAO - \{C_{L_i} - CLQ[\dot{\theta}]\} \qquad (89a)$$

$$f'(\alpha_{i_k}) = (X)\cdot(CLAX)\ \alpha_{i_k}^{X-1} + CLA \qquad (89b)$$

$$f''(\alpha_{i_k}) = (X)\cdot(X-1)\cdot(CLAX)\ \alpha_{i_k}^{X-2}\ , \qquad (89c)$$

where α_{i_k} is the bias-free value of the α-data at time point i, then the value of $\alpha_{i_{k+1}}$ closest to α_{i_k} which will make $f(\alpha_{i_{k+1}}) \to 0$ is given by

*We recognize that the values found for CLAO, CLA, CLAX, and X will vary somewhat as the center of gravity location - and to some extent the weight and altitude - is changed because they include a lift contribution arising from the elevator deflection required to attain trimmed flight. This lift contribution varies only with speed - hence α, if the weight and altitude are relatively constant. In maneuvering flight an additional elevator deflection (and thus an additional lift component) is necessary to induce rotation; this can be accounted for by a term proportional to $\dot{\theta}$ so that the α contribution found by the LSD method will then be virtually independent of rotational velocity. At a given c.g. location, initial weight, nominal altitude, and throttle position, the CLAO, CLA, CLAX, and X found by this approach should be the same whether the aircraft performs a level flight acceleration - deceleration or a pullup - pushover. The values of CLAO, CLA, CLAX, and X, however, may also depend upon throttle position because (a) the thrust axis may not intersect the c.g., (b) the lift distribution over the wing may be affected by the application of power, and (c) the flow field approaching the horizontal tail may be altered. For this reason the coefficient values should be determined at several different power settings, different altitudes, and different weights. One would also expect the drag coefficient values to be somewhat dependent upon power level.

$$\alpha_{i_{k+1}} = \alpha_{i_k} - \frac{f'(\alpha_{i_k})}{f''(\alpha_{i_k})} \pm \sqrt{\left[\frac{f'(\alpha_{i_k})}{f''(\alpha_{i_k})}\right]^2 - 2\left[\frac{f(\alpha_{i_k})}{f''(\alpha_{i_k})}\right]} \qquad (90)$$

The choice of signs on the radical is made according to the following rationale:

If $f'(\alpha_{i_k}) \cdot f''(\alpha_{i_k}) < 0$ use the negative sign on the radical.

If $f'(\alpha_{i_k}) \cdot f''(\alpha_{i_k}) > 0$ use the positive sign on the radical.

Occasionally,

$$\left[\frac{f'(\alpha_{i_k})}{f''(\alpha_{i_k})}\right]^2 - 2\left[\frac{f(\alpha_{i_k})}{f''(\alpha_{i_k})}\right] < 0$$

because the radius of curvature of $f(\alpha_{i_k})$ at α_{i_k} no longer intersects the abscissa. When this happens, the computer cannot perform the operation. In such a circumstance the following procedure is suggested:

1. Choose as an initial estimate for $\alpha_{i_{k+1}}$

$$\alpha_{i_{k+1}} = \alpha_{i_k} - \frac{f'(\alpha_{i_k})}{f''(\alpha_{i_k})} \qquad (91)$$

2. If $|f(\alpha_{i_{k+1}})| < |f(\alpha_{i_k})|$, then try (90) again.

3. If the radicand is again negative, try

$$\alpha_{i_{k+2}} = \alpha_{i_{k+1}} - \frac{f'(\alpha_{i_{k+1}})}{f''(\alpha_{i_{k+1}})} \qquad (92)$$

and see if $|f(\alpha_{i_{k+2}})| < |f(\alpha_{i_{k+1}})|$. As long as

$|f(\alpha_{i_{k+n}})| < |f(\alpha_{i_{k+n-1}})|$, use either (90) or (91) as indicated.

4. Continue until either $|f(\alpha_{i_{k+n}})| < 10^{-15}$ or $|f'(\alpha_{i_{k+n}})| < 10^{-15}$.

In the former case the new root is found with sufficient accuracy. In the latter, a real root does not exist close to the starting point and we select the value of α for which $f(\alpha)$ approaches zero most closely. Note that the use of a least squares procedure does not guarantee that the coefficients chosen for any particular data point yield a root, only that the sum of $[f(\alpha_i)]^2$ is a minimum for the particular model used. Thus, an individual $f(\alpha_i)$ may be non-zero with no crossing of the abscissa for any α close to α_i.

With the revised set of α values given by the foregoing procedure, we now reenter the coefficient extraction routine, i.e., equation (6) or some alternate version thereof, with $\gamma = \theta - \alpha$ to find "updated" values of the P and C_D coefficients. We look, of course, for the model giving the lowest fit error. Its coefficients, along with the data, form the basis of our next step.

3. Modification of α-data to yield a more Consistent Data Set

In this step we seek to modify α slightly at each point in time by a different amount so as to (a) more nearly satisfy equation (81) at all times and (b) reduce the fit error obtained with equation (6). We begin by using the latest power data in (81) and solving for $C_L(t)$. With the least-squares-distance procedures we then update the values for CLAO, CLA, CLAX, and X. If we now substitute for α_i an "improved" value which is given by

$$\alpha_i + F \Delta \alpha_i ,$$

where F is a factor permitting us to apply all or part of the correction during any particular iteration, and where $\Delta\alpha_i$ is defined* by

*$\Delta\alpha_i$ is the value by which α_i must be changed to satisfy (81) exactly. We could of course employ our Newton-Raphson procedure to determine it. We have chosen, however, to assume that $\Delta\alpha_i$ is very small and can be represented with satisfactory accuracy by one term in a binomial expansion.

$$\Delta\alpha_i = \frac{\dot{\gamma}_i + \frac{g}{V_i}\cos\gamma_i - \frac{g\,S\rho_i\,V_i}{2W_i}\left\{CLQ(\dot{\theta}_i)+CLAO+CLA(\alpha_i)+CLAX(\alpha_i)^{\times}\right\} - \frac{g\,P_i}{W_i V_i^2}\sin\alpha_i}{\frac{g\,S\rho_i\,V_i}{2W_i}\,X\cdot CLAX\cdot\alpha_i + CLA + \frac{g\,P_i\cos\alpha_i}{W_i\,V_i^2}}, \qquad (93)$$

Then the sum of the squares of the amount by which we fail to satisfy equation (81) at each time point (a quantity which we call S_2) should decrease. We will usually take F = 0.3 on the first two iterations and 1.0 on subsequent iterations. Before we substitute $\alpha_i + F\,\Delta\,\alpha_i$ for α_i in equation (6), however, we will update the θ-data so that it is more consistent with both γ and the revised α values. We assume for the present purpose that θ contains a gain error and a bias error which we will determine by fitting the θ-data with

$$\sin^{-1}\left[\frac{\dot{h}}{v}\right] + \alpha_i + F\,\Delta\,\alpha_i = A\,\theta_i + B \qquad (94)$$

in order to determine A and B in a least squares sense. The new θ_i is simply $A\,\theta_{i_{old}} + B$. This value of θ plus the revised α value are then substituted into the appropriate version of equation (6) to extract the coefficient values. With new power coefficients from this extraction the cycle is repeated until the fit error, S, reaches a minimum, usually in two or three more iterations. This minimum is determined by comparing the fit error after each iteration with the fit error obtained for the previous iteration.

It will be observed that the power, computed using the coefficients obtained from the last extraction, is the principal mechanism by which $\Delta\alpha_i$ is modified in (93). It will also be observed that $\Delta\alpha_i$ is relatively

insensitive to very small changes in power. As a result, when the fit error for 300 points is less than about 10^{-10}, the $\Delta\alpha_i$ are generally 2×10^{-4} or less. These small modifications in α result in total power values which are very little different from those of the previous iteration. Hence, the reduction in fit error during the next iteration becomes miniscule. Some other means must therefore be employed to speed the reduction of the fit error to the desired range of 10^{-13} or less.

4. Modification of α-data by Trajectory Comparison

What we have as a result of the previous procedures is a set of lift, drag, and power coefficients obtained in a least squares manner from input V, h, and W data and modified α and θ data. We will now use the coefficient set and some assumptions regarding the accuracy of the input data to calculate the trajectory of the vehicle during the time in question. As the vehicle moves along its trajectory in the terrestrial X-Z plane, its position in space and its orientation may be described by a set of time histories. These time histories are the solutions of the system of equations (6), (81), (82), and (83) plus the relationship

$$\dot{W} = - cP \tag{95}$$

where c is the specific fuel consumption. Examination of the system will show that two of the 5 time histories must be specified a priori in order to obtain a unique solution. As we have indicated, we choose to assume that V and h and their derivatives may be considered to be accurate and noise-free. As a result we may readily develop the following time histories:

$$\begin{array}{lll} V(t) & h(t) & \rho(t) \\ \dot{V}(t) & \dot{h}(t) & \gamma(t) \\ \ddot{V}(t) & \ddot{h}(t) & \dot{\gamma}(t). \end{array} \tag{96}$$

If we now combine equations (6) and (81) to yield

$$\frac{\dot{\gamma}_i}{g} + \frac{\cos \gamma_i}{V_i} = \frac{\rho_i S V_i}{2W_i} C_{L_i} + \frac{\tan \alpha_i}{V_i}\left[\frac{\dot{V}_i}{g} + \sin \gamma_i + \frac{\rho_i S V_i^2}{2W_i} C_{D_i}\right] \tag{97}$$

we observe that as a consequence of (96) only $\alpha(t)$ and $W(t)$ are unknown in (97). But (95) can be written

$$W_{i+1} = W_i - c[P_0 + P_1 V_i + P_2 V_i^2]\,\Delta t - c\left(\frac{\Delta t}{2}\right)^2 [P_1 \dot{V}_i + 2P_2 V_i \dot{V}_i]$$

$$- c\left(\frac{\Delta t}{6}\right)^3 [P_1 \ddot{V}_i + 2P_2(\dot{V}_i^2 + V_i \ddot{V}_i)] \,. \qquad (98)$$

This permits us to determine W(t) given its initial value. With the results of (98) substituted into (97), we may solve (97) at each time point for α_i using the second order Newton-Raphson scheme. Thus, we can determine the $\alpha(t)$ which is compatible with any particular set of C_L, C_D, and P coefficients and the time histories given by (96).

$\alpha(t)$ found in this manner will not be the same as that found from step 3 above. We desire to modify the α-data resulting from step 3 so that it will be somewhat closer to that given by the trajectory computation. At the same time we wish to modify the C_L, C_D, and P coefficients so that they will yield an α-trajectory closer to the $\alpha(t)$ resulting from step 3. We begin as follows. If we call α_{m_i} the value of α_i resulting from step 3 and α_{t_i} the result of the trajectory calculation, then the result we seek is to minimize

$$J = \sum_{i=1}^{N} [(\alpha_{m_i} - \alpha_{t_i})^2] \,. \qquad (99)$$

This will occur when $\frac{\partial J}{\partial C_{D_0}}, \frac{\partial J}{\partial C_{D_1}}, \frac{\partial J}{\partial C_{D_2}}, \ldots, \frac{\partial J}{\partial CLAX} = 0.$

In order to minimize J with respect to all eight C_D and C_L coefficients simultaneously, we observe that a first order Taylor series expansion for $\frac{\partial J}{\partial C_{D_0}}$ in terms of the eight coefficients may be written

$$\left[\frac{\partial J}{\partial C_{D_0}}\right]_{k+1} = \left[\frac{\partial J}{\partial C_{D_0}}\right]_k + \frac{\partial}{\partial C_{D_0}}\left[\frac{\partial J}{\partial C_{D_0}}\right](C_{D_{0_{k+1}}} - C_{D_{0_k}}) + \frac{\partial}{\partial C_{D_1}}\left[\frac{\partial J}{\partial C_{D_0}}\right](C_{D_{1_{k+1}}} - C_{D_{1_k}})$$

$$+ \frac{\partial}{\partial C_{D_2}}\left[\frac{\partial J}{\partial C_{D_2}}\right](C_{D_{2_{k+1}}} - C_{D_{2_k}}) + \ldots.$$

$$\text{or} \quad \left[\frac{\partial J}{\partial C_{D_0}}\right]_{k+1} = \left[\frac{\partial J}{\partial C_{D_0}}\right]_k + \sum_{\ell=1}^{8} \frac{\partial}{\partial C_\ell}\left[\frac{\partial J}{\partial C_{D_0}}\right](C_{\ell_{k+1}} - C_{\ell_k}) \qquad (100)$$

where $C_1 = C_{D_0}$, $C_2 = C_{D_1}$, $C_3 = C_{D_2}$, ...,

$$\frac{\partial J}{\partial C_{D_0}} = 2 \sum_{i=1}^{N} \left[(\alpha_{m_i} - \alpha_{t_i}) \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} \right], \tag{101}$$

and

$$\frac{\partial}{\partial C_\ell} \left(\frac{\partial J}{\partial C_{D_0}} \right) = 2 \sum_{i=1}^{N} \left[(\alpha_{m_i} - \alpha_{t_i}) \frac{\partial^2 \alpha_{t_i}}{\partial C_{D_0} \partial C_\ell} - \left(\frac{\partial \alpha_{t_i}}{\partial C_{D_0}} \right) \left(\frac{\partial \alpha_{t_i}}{\partial C_\ell} \right) \right]. \tag{102}$$

We will assume that we can neglect $(\alpha_{m_i} - \alpha_{t_i}) \frac{\partial^2 \alpha_{t_i}}{\partial C_{D_0} \partial C_\ell}$ in comparison to the other term in (102). Such a step will not affect the final answer, only the rate of convergence. In this particular instance the $\frac{\partial \alpha_{t_i}}{\partial C_\ell}$ must be evaluated numerically although, where possible, it is desirable to do this analytically. The value of the derivative at a particular time point is found by determining the change in α_{t_i} produced by small changes (1%) to either side of the original value of C_L in (97). All other C_ℓ's are held constant during the process.

When $C_{\ell_{k+1}}$ have the proper values, all the $\left(\frac{\partial J}{\partial C_\ell} \right)_{k+1} = 0$. This fact permits us to write a system of eight linear equations,

$$\begin{aligned}
&\left(\frac{\partial J}{\partial C_{D_0}} \right)_k + \sum_{\ell=1}^{8} \left[\frac{\partial}{\partial C_\ell} \left(\frac{\partial J}{\partial C_{D_0}} \right)_k (C_{\ell_{k+1}} - C_{\ell_k}) \right] = 0 , \\
&\qquad \vdots \\
&\left(\frac{\partial J}{\partial CLAX} \right)_k + \sum_{\ell=1}^{8} \left[\frac{\partial}{\partial C_\ell} \left(\frac{\partial J}{\partial CLAX} \right)_k (C_{\ell_{k+1}} - C_{\ell_k}) \right] = 0 ,
\end{aligned} \tag{103}$$

which we must solve for the eight new values of $C_{\ell_{k+1}}$. Although we may not actually wish to obtain the solutions in this fashion, we can find them from

$$C_{\ell_{k+1}} = C_{\ell_k} + \{A\}^{-1} \{B\}^{*} , \tag{104}$$

where $\{A\} =$

$$\begin{bmatrix} 2 \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} & \cdots & 2 \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} \frac{\partial \alpha_{t_i}}{\partial CLAX} \\ \vdots & & \vdots \\ 2 \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial CLAX} \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} & \cdots & 2 \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial CLAX} \frac{\partial \alpha_{t_i}}{\partial CLAX} \end{bmatrix} \tag{105}$$

$$\{B\} = \begin{bmatrix} 2 \sum_{i=1}^{N} (\alpha_{m_i} - \alpha_{t_i}) \frac{\partial \alpha_{t_i}}{\partial C_{D_0}} \\ \vdots \\ 2 \sum_{i=1}^{N} (\alpha_{m_i} - \alpha_{t_i}) \frac{\partial \alpha_{t_i}}{\partial CLAX} \end{bmatrix} . \tag{106}$$

(104) is in effect a generalized first order Newton-Raphson procedure.

With the $C_{\ell_{k+1}}$ values substituted into (97) we determine a new trajectory. We call the α values for this new trajectory $\bar{\alpha}_{t_i}$. We then define

$$\bar{\alpha}_{m_i} = \alpha_{m_i} + 0.5 (\bar{\alpha}_{t_i} - \alpha_{m_i}) \tag{107}$$

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*The A matrix in this formulation may, for some sets of physical data, be rather ill-conditioned. As a result, the values of $C_{\ell_{k+1}}$ obtained by various solution techniques may all be substantially in error as well as different. The user should therefore employ the actual technique presented in subsequent sections of this report with care until the reasonableness of the solutions is apparent.

and $\theta_i = \gamma_i + \bar{\alpha}_{m_i}$. With these values plus the measured values of V_i, $\dot{V}_i$, ρ_i, $\dot{\gamma}_i$, and W_i, we enter the coefficient extraction routine and the C_L vs. α curve fit procedure to obtain new power, drag, and lift coefficients and to check the resulting fit error.

Prior to beginning another iteration of this process with the latest C_L and C_D coefficients, we update our value for the specific fuel consumption, c, in the following fashion:

$$c = \frac{1}{N-1} \sum_{j=1}^{N-1} \left(\frac{W_{j+1} - W_j}{P_j} \right). \tag{108}$$

Here, W_j are the input values of the weight and P_j are the values of the power computed using the latest power coefficient.

By repeating the foregoing trajectory comparison with the updated value of $\bar{\alpha}_{m_i}$ two or three times, we arrive at a situation where both the α values and the fit errors have improved. By this time, however, $(\bar{\alpha}_{m_i} - \bar{\alpha}_{t_i}) \to 0$, so that no further improvement is possible with this approach.

It will be evident after a short reflection that if a negative C_{D_1} is obtained during a coefficient extraction, the implication is that α for zero lift is positive. This is a condition the designer of the aircraft will usually avoid if he is aware of it because it leads inherently to high cruise drag with conventional quasi-symmetric fuselages. Thus, if the minimum fit error model contains a C_{D_1} which, as a result of the least squares curve fit procedure, yields a negative value, one would appear to be justified on physical grounds in using as the basis for further operations the most similar model having C_{D_1} and $C_{D_3} \equiv 0$. This is a procedure we will usually follow in applying the foregoing trajectory comparison to reduce the noise in the α-channel.

It is necessary to point out, however, that light aircraft fuselages tend to be very non-symmetric about their x-y planes. It is possible, because of this asymmetry, that the minimum fuselage drag does not occur when the relative wind is parallel to the x-body axis. If the existence of this condition is suspected for the aircraft under test, the negative value for C_{D_1} must be accepted.

The benefit obtained from the α-trajectory comparison described in this section and the preceding three noise-reduction steps has been to reduce the noise in the α and θ channels and improve the overall data consistency to the point that the extracted coefficients are usually sufficiently close to the "correct" values that they can form a useful starting set for the application of a Newton-Raphson identifier.

Application of Newton-Raphson Identifier

The Newton-Raphson identifier as employed by Taylor and Iliff (Ref. 15) and others is a means of finding the values of unknown coefficients in the equations of motion which tend to minimize the squares of differences

between the measured time histories of aircraft state parameters and computed solutions to the equations of motion involving the same parameters. It is assumed that the solutions change linearly with a change in coefficient value. Furthermore, since the equations of motion used by Iliff and Taylor are linear first-order differential equations, the solutions are readily determined and the "cost function" minimization procedure can be joined with the solution procedure without undue difficulty. When forming the cost function it is desirable to include as many independent differences between measurement and computation as possible, since the more closely the number of differences approaches the number of unknowns in the problem, the more determinant it is, i.e., the more likely the procedure is to give reasonable coefficient values.

The present problem differs from that of Iliff and Taylor in that the equations of motion are non-linear. The solution procedure is therefore quite different, much more complex, and must be carried out independently of the minimization. The minimization yields a linearized approximation to the change in the coefficient values needed to minimize the difference between the flight time histories and the computed values of the same states. In the limit as the differences approach zero, the linearized approximations approach the exact values. Another significant difference from the Iliff and Taylor approach is that the present equations of motion have no specific forcing function(s). As noted above, any two states which are known *a priori* may serve this purpose. We have chosen to use the true airspeed along the flight path as the principle forcing function. Since the power into the airstream is specified as a function of true airspeed in our formulation of the problem, the power at any time is known if the coefficients in the power-velocity model are given. We use as initial coefficient values for this model those obtained from the previous noise-reduction procedure.† With the power and velocity specified as functions of time, it is then possible to determine a unique trajectory. The procedure is as follows:

1. Determine the weight at t_{j+1} from

$$W_{j+1} = W_j - c\Delta t(P_0 + P_1 V_j + P_2 V_j^2) - c\frac{\Delta t^2}{2}(P_1 \dot{V}_j + 2P_2 V_j \dot{V}_j)$$
$$- c\frac{\Delta t^3}{6}(P_1 \ddot{V}_j + 2P_2 \dot{V}_j^2 + 2P_2 V_j \ddot{V}_j)$$
$$- c\frac{\Delta t^4}{24}(P_1 \dddot{V}_j + 6P_2 \dot{V}_j \ddot{V}_j + 2P_2 V_j \dddot{V}_j) \qquad (109)$$

$W_{j=1}$ = weight at beginning of maneuver (from test data)

V_j is specified

$\dot{V}_j, \ddot{V}_j, \dddot{V}_j$ are computed by the method of splines from V_j, $\dot{V}_j$, and $\ddot{V}_j$

†It is well known that the rate of convergence of the Newton-Raphson procedure decreases as the error in the estimated values of the coefficients increases. Thus it is desirable to begin the procedure with values as close to the "correct" values as one can reasonably manage.

2. $\gamma_{j=1}$ is determined from $\sin^{-1}(\dot{h}_1/V_1)$ since h_1 and $\dot{h}_1$ are available from the measured data. $\rho_{j=1}$ is determined from

$$\rho_{j=1} = \rho_0(1-6.86 \times 10^{-6}\ h_{j=1})^{4.26} . \tag{110}$$

3. α_j is found from

$$\frac{\dot{V}_j}{g} + \sin\gamma_j = \frac{(P_0+P_1V_j+P_2V_j^2)\cos\alpha_j}{W_jV_j} - \frac{\rho_j SV_j^2}{2W_j}[C_{D_0} + C_{D_2}\alpha_j^2 + C_{D_4}\alpha_j^6] \tag{111}$$

by the second-order Newton-Raphson technique.

4. $\dot{\gamma}_j$ is given by

$$\dot{\gamma}_j = \frac{g\rho_j SV_j C_L(\alpha_j)}{2W_j} + \frac{g(P_0 + P_1V_j + P_2V_j^2)\sin\alpha_j}{W_jV_j^2} - \frac{g\cos\gamma_j}{V_j} . \tag{112}$$

5. γ_{j+1} is determined by forward integration of (112) using the following scheme:

   a. With the Runge-Kutta method, determine γ for the first 8 points of the data set.

   b. With γ, α, w, and ρ known at these points, one can then find $\dot{\gamma}$ at the eight points through (112).

   c. Represent $\dot{\gamma}(t)$ over the last six points of the interval by a fifth-order polynomial using Newton's interpolation formula:

$$\dot{\gamma}(t) = a_o + a_1(t - t_{j-5}) + a_2(t - t_{j-5})(t - t_{j-4}) + a_3(t - t_{j-5})$$
$$\cdot (t - t_{j-4})(t - t_{j-3}) + a_4(t - t_{j-5})(t - t_{j-4})(t - t_{j-3})(t - t_{j-2})$$
$$+ a_5(t - t_{j-5})(t - t_{j-4})(t - t_{j-3})(t - t_{j-2})(t - t_{j-1}) , \tag{113a}$$

where $a_o = \dot{\gamma}_{j-5}$

$$a_1 = \frac{\dot{\gamma}_{j-4} - \dot{\gamma}_{j-5}}{t_{j-4} - t_{j-5}}$$

$$a_2 = [\dot{\gamma}_{j-3} - (a_o + a_1 \{t_{j-3} - t_{j-5}\})]/[(t_{j-3} - t_{j-5})(t_{j-3} - t_{j-4})]$$

$$a_3 = [\dot{\gamma}_{j-2} - (a_o + a_1\{t_{j-2} - t_{j-5}\} + a_2(t_{j-2} - t_{j-5})(t_{j-2} - t_{j-4}))]$$

$$\div [(t_{j-2} - t_{j-5})(t_{j-2} - t_{j-4})(t_{j-2} - t_{j-3})]$$

$$a_4 = [\dot{\gamma}_{j-1} - (a_o + a_1\{t_{j-1} - t_{j-5}\} + a_2(t_{j-1} - t_{j-5})(t_{j-1} - t_{j-4})$$

$$+ a_3(t_{j-1} - t_{j-5})(t_{j-1} - t_{j-4})(t_{j-1} - t_{j-3}))]/[(t_{j-1} - t_{j-5})$$

$$\cdot (t_{j-1} - t_{j-4})(t_{j-1} - t_{j-3})(t_{j-1} - t_{j-2})]$$

$$a_5 = [\dot{\gamma}_j - (a_o + a_1\{t_j - t_{j-5}\} + a_2(t_j - t_{j-5})(t_j - t_{j-4})$$

$$+ a_3(t_j - t_{j-5})(t_j - t_{j-4})(t_j - t_{j-3}) + a_4(t_j - t_{j-5})(t_j - t_{j-4})$$

$$\cdot (t_j - t_{j-3})(t_j - t_{j-2}))]/[(t_j - t_{j-5})(t_j - t_{j-4})(t_j - t_{j-3})$$

$$\cdot (t_j - t_{j-2})(t_j - t_{j-1})].$$

d. Extrapolate the formula to t_{j+1}. This is done simply by letting $t \leq t_{j+1}$.

e. Integrate the extrapolated formula term-by-term analytically and evaluate the result between the limits t_{j-5} and t_{j+1}:

$$\hat{\gamma}_{j+1} = \gamma_{j-5} + \int_{t_{j-5}}^{t_{j+1}} \dot{\gamma}\, dt$$

$$\text{or } \hat{\gamma}_{j+1} = \gamma_{j-5} + \dot{\gamma}_{j-5}(t_{j+1} - t_{j-5}) + \frac{\dot{\gamma}_{j-4} - \dot{\gamma}_{j-5}}{t_{j-4} - t_{j-5}}\left[\frac{1}{2}(t_{j+1}^2 - t_{j-5}^2) - t_{j-5}(t_{j+1} - t_{j-5})\right] + \ldots . \tag{113b}$$

At each step we then subtract t_{j-5} from all time values in order to extend the formula's range.

f. Estimate ρ_{j+1} from

$$\hat{\rho}_{j+1} = \rho_j + 4.26\rho_o(1 - 6.86 \times 10^{-6} h_j)^{3.26} (-6.86 \times 10^{-6}) V_j \sin \gamma_j \Delta t \tag{114a}$$

and α_{j+1} initially from

$$\hat{\alpha}_{j+1} = \alpha_j + 0.25\left[\frac{\alpha_j - \alpha_{j-1}}{t_j - t_{j-1}}\right]\Delta t \tag{114b}$$

with corrections which are determined by comparing the value of γ_{j+1} from (113b) using the $\hat{\rho}_{j+1}$ and $\hat{\alpha}_{j+1}$ with the value of γ_{j+1} from (111) using the same ρ and α values. Then

$$(\hat{\alpha}_{j+1})_{k+1} = (\hat{\alpha}_{j+1})_k + \frac{(\Delta \gamma_{j+1})_k}{\left[\left(\frac{\partial \gamma}{\partial \alpha}\right)_{j+1}\right]_k}, \tag{115a}$$

$$\text{where } \frac{\partial \gamma}{\partial \alpha} = \frac{-(P \sin \hat{\alpha}/wv) - \frac{\rho s v^2}{2w}\left[2\hat{\alpha} C_{D_2} + 6C_{D_4} \hat{\alpha}^5\right]}{\sqrt{1 - \left(\frac{P \cos \hat{\alpha}}{wv} - \frac{\rho s v^2}{2w} C_D - \frac{\dot{V}}{g}\right)^2}}. \tag{115b}$$

These k iterations are continued until $\Delta\gamma_{j+1} < 10^{-13}$. As a result, γ_{j+1} computed by the predictor equator (113b) is compatible with the other variable values to a high degree.

g. Determine $\dot{\hat{\gamma}}_{j+1}$ from (112) using the latest predicted values of $\hat{\gamma}_{j+1}$, $\hat{\rho}_{j+1}$, and $\hat{\alpha}_{j+1}$. Calculate a <u>corrected</u> value for γ_{j+1} from

$$\gamma_{j+1} = \gamma_{j-5} + \int_{t_{j-5}}^{t_{j+1}} \dot{\gamma}\, dt \tag{116a}$$

where now

$$\dot{\gamma} = -P(\gamma - \gamma_{j-5}) + A + B(t - t_{j-5}) + C(t - t_{j-5})^2 + D(t - t_{j-5})^3 + E(t - t_{j-5})^4 + F(t - t_{j-5})^5 \tag{116b}$$

if $P > 10^{-2}$. In this equation, an extension of the procedure described by Smith in Ref. 2,

$$P = -\left[\frac{-\dot{\gamma}_{j+1} + 6\dot{\gamma}_j - 15\dot{\gamma}_{j-1} + 20\dot{\gamma}_{j-2} - 15\dot{\gamma}_{j-3} + 6\dot{\gamma}_{j-4} - \dot{\gamma}_{j-5}}{-\gamma_{j+1} + 6\gamma_j - 15\gamma_{j-1} + 20\gamma_{j-2} - 15\gamma_{j-3} + 6\gamma_{j-4} - \gamma_{j-5}}\right]$$

$$A = \dot{\gamma}_{j-5}$$

$$B = \left(\frac{12\dot{\gamma}_j - 75\dot{\gamma}_{j-1} + 200\dot{\gamma}_{j-2} - 300\dot{\gamma}_{j-3} + 300\dot{\gamma}_{j-4} - 137\dot{\gamma}_{j-5}}{60(t_{j-4} - t_{j-5})}\right) + P\left(\frac{12\gamma_j - 75\gamma_{j-1} + 200\gamma_{j-2} - 300\gamma_{j-3} + 300\gamma_{j-4} - 137\gamma_{j-5}}{60(t_{j-4} - t_{j-5})}\right)$$

$$C = \left(\frac{-10\dot{\gamma}_j + 61\dot{\gamma}_{j-1} - 156\dot{\gamma}_{j-2} + 214\dot{\gamma}_{j-3} - 154\dot{\gamma}_{j-4} + 45\dot{\gamma}_{j-5}}{24(t_{j-4} - t_{j-5})^2}\right) + P\left(\frac{-10\gamma_j + 61\gamma_{j-1} - 156\gamma_{j-2} + 214\gamma_{j-3} - 154\gamma_{j-4} + 45\gamma_{j-5}}{24(t_{j-4} - t_{j-5})^2}\right)$$

$$D = \left(\frac{7\dot{\gamma}_j - 41\dot{\gamma}_{j-1} + 98\dot{\gamma}_{j-2} - 118\dot{\gamma}_{j-3} + 71\dot{\gamma}_{j-4} - 17\dot{\gamma}_{j-5}}{24(t_{j-4} - t_{j-5})^3}\right) + P\left(\frac{7\gamma_j - 41\gamma_{j-1} + 98\gamma_{j-2} - 118\gamma_{j-3} + 71\gamma_{j-4} - 17\gamma_{j-5}}{24(t_{j-4} - t_{j-5})^3}\right)$$

$$E = \left(\frac{-2\dot{\gamma}_j + 11\dot{\gamma}_{j-1} - 24\dot{\gamma}_{j-2} + 26\dot{\gamma}_{j-3} - 14\dot{\gamma}_{j-4} + 3\dot{\gamma}_{j-5}}{24(t_{j-4} - t_{j-5})^4}\right)$$

$$+ P\left(\frac{-2\gamma_j + 11\gamma_{j-1} - 24\gamma_{j-2} + 26\gamma_{j-3} - 14\gamma_{j-4} + 3\gamma_{j-5}}{24(t_{j-4} - t_{j-5})^4}\right)$$

$$F = \left(\frac{\dot{\gamma}_j - 5\dot{\gamma}_{j-1} + 10\dot{\gamma}_{j-2} - 10\dot{\gamma}_{j-3} + 5\dot{\gamma}_{j-4} - \dot{\gamma}_{j-5}}{120(t_{j-4} - t_{j-5})^5}\right)$$

$$+ P\left(\frac{\gamma_j - 5\gamma_{j-1} + 10\gamma_{j-2} - 10\gamma_{j-3} + 5\gamma_{j-4} - \gamma_{j-5}}{120(t_{j-4} - t_{j-5})^5}\right) \qquad (116c)$$

for the case in which the time intervals are even. For uneven time intervals, the expressions are much more complex.

If $P \leq 10^{-2}$, we represent $\dot{\gamma}$ in (116a) by (113a) plus the term

$$a_6(t - t_{j-5})(t - t_{j-4})(t - t_{j-3})(t - t_{j-2})(t - t_{j-1})(t - t_j) \qquad (116d)$$

where $a_6 = [\hat{\dot{\gamma}}_{j+1} - (a_o + a_1\{t_{j+1} - t_{j-5}\} + a_2(t_{j+1} - t_{j-5})(t_{j+1} - t_{j-4})$

$$+ a_3(t_{j+1} - t_{j-5})(t_{j+1} - t_{j-4})(t_{j+1} - t_{j-3}) + a_4(t_{j+1} - t_{j-5})$$

$$\cdot (t_{j+1} - t_{j-4})(t_{j+1} - t_{j-3})(t_{j+1} - t_{j-2}) + a_5(t_{j+1} - t_{j-5})$$

$$\cdot (t_{j+1} - t_{j-4})(t_{j+1} - t_{j-3})(t_{j+1} - t_{j-2})$$

$$\cdot (t_{j+1} - t_{j-1}))]/[(t_{j+1} - t_{j-5})(t_{j+1} - t_{j-4})(t_{j+1} - t_{j-3})$$

$$\cdot (t_{j+1} - t_{j-2})(t_{j+1} - t_{j-1})(t_{j+1} - t_j)] . \qquad (116e)$$

The $\hat{\dot{\gamma}}_{j+1}$ in (116c) or (116e) is obtained from the predictor equation (113b). Its use in the corrector equation (116a) gives us the final, updated value of γ_{j+1}. Despite the attention to accuracy evidenced by the use of this procedure, the very "stiff" nature of (112), the fact that the Taylor expansion for h(see below) is truncated at four terms, and the fact that with any forward integration scheme the errors accumulate as one marches along, require that the step size be kept relatively small (0.01 sec. or less) if the desired accuracy (errors no larger than 1 part in 10^6 for a 30 second trajectory) is to be maintained. As a result, run times per iteration will be on the order of 4 minutes on an IBM 370/165.

6. h_{j+1} is found from

$$h_{j+1} = h_j + (V_j \sin\gamma_j)\Delta t + (\dot{V}_j \sin\gamma_j + V\dot{\gamma}_j \cos\gamma_j)\frac{\Delta t^2}{2}$$

$$+ (\ddot{V}_j \sin\gamma_j + \dot{V}_j\dot{\gamma}_j \cos\gamma_j + V\ddot{\gamma}_j \cos\gamma_j - V\dot{\gamma}_j^2 \sin\gamma_j)\frac{\Delta t^3}{6}$$

$$+ \left[(\dddot{V}_j - 2\dot{V}_j\dot{\gamma}_j^2 - 3V_j\dot{\gamma}_j\ddot{\gamma}_j)\sin\gamma_j + (2\ddot{V}_j\dot{\gamma}_j + 2\dot{V}_j\ddot{\gamma}_j + V_j\dddot{\gamma}_j - V_j\dot{\gamma}_j^3)\cos\gamma_j\right]\frac{\Delta t^4}{24}^{*} \quad (117)$$

and ρ_{j+1} from h_{j+1}. $\ddot{\gamma}$ and $\dddot{\gamma}$ are found by differentiating (113a) and (116d) analytically. (118)

7. With ρ_{j+1} and γ_{j+1} known, α_{j+1} is determined by the Newton-Raphson technique from (111).

All of the variable values at t_{j+1} have now been determined. The process is then repeated to find the variable values at t_{j+2} and so on to t_N.

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*A four term expansion is used because to employ additional terms would require data which are not readily available. High accuracy in the representation of the altitude can therefore be maintained only by using a relatively small step size.

The determination of $h(t)$, $\alpha(t)$, $\rho(t)$, $\gamma(t)$, $\dot{\gamma}(t)$, and $W(t)$ by this integration procedure provides the raw material from which one can form and evaluate a cost function. It will be recalled that we have assumed the measured values of V and h and their derivatives to be correct. We can, as a result, form the following "measured" variables:

$$h_{m_i},$$

$$\gamma_{m_i} = \sin^{-1}\left(\frac{\dot{h}_{m_i}}{V_{m_i}}\right),$$

$$\dot{\gamma}_{m_i} = \frac{1}{\sqrt{1 - \left(\frac{\dot{h}_{m_i}}{V_{m_i}}\right)^2}}\left[\frac{\ddot{h}_{m_i}}{V_{m_i}} - \frac{\dot{h}_{m_i}\dot{V}_{m_i}}{V_{m_i}^2}\right], \tag{119}$$

and

$$E_{m_i} = h_{m_i} + \frac{V_{m_i}^2}{2g},$$

all of which may be compared with values computed along the trajectory. Furthermore, the variation of each of these variables with each of the power, lift, and drag coefficients can be evaluated <u>analytically</u>* for each time point.

We can also develop two additional comparisons if we are willing to make some assumptions regarding the quality and character of the flight data. We will develop a "measured" weight time history by fitting a fourth-order polynomial to the computed values of W_i. At W_1 and W_N, however, the experimental values weighted by N^3 are used in the least squares curve fit routine. The partial derivatives of W_{T_i} with respect to the power coefficients can, of course, be readily evaluated analytically.

If we now assume that the filtered value of $\dot{\theta}$ has an accuracy roughly comparable to that of V and h, then we can take as the "measured" value of α

*An analytical evaluation is both faster and more accurate than a numerical one.

$$\alpha_{m_i} = \int_{t_{i=1}}^{t_i} \dot{\theta}_{m_i}\, dt + \theta_1 - \sin^{-1}\left[\frac{\dot{h}_{m_i}}{V_{m_i}}\right] \qquad (120)$$

In this case the partial derivatives of α_{t_i} with respect to the lift and drag coefficients must be evaluated numerically by the Newton-Raphson procedure. The partials of α_{t_i} with respect to the power coefficients are taken to be zero. Alternately, the measured values of α may be used in place of those computed by (120) if α is known to be accurate. These procedures permit us to form the following cost function:

$$J_2 = \sum_{i=1}^{N}\Big[D_1(h_{m_i} - h_{t_i})^2 + D_2(\gamma_{m_i} - \gamma_{t_i})^2 + D_3(\dot{\gamma}_{m_i} - \dot{\gamma}_{t_i})^2 + D_4(W_{m_i} - W_{t_i})^2$$

$$+ D_5(E_{m_i} - E_{t_i})^2 + D_6(\alpha_{m_i} - \alpha_{t_i})^2\Big], \qquad (121)$$

where the D's are weights which may be applied to the various differences. If, for example, α_m is not regarded highly, its weight, D_6, may be taken to be very small compared with the other weights. We may then proceed as before to determine the changes in the 13 (possible) coefficients which tend to minimize J_2 by minimizing $(h_{m_i} - h_{t_i})$, etc.* With the new coefficient values we then proceed to calculate a new trajectory, find a new value for the cost function, develop new coefficient values, and so on, until $J_2 < 10^{-13}$ or is as small as it will get.

In order to add the various constituent items of the cost function (121) properly, it is desirable that each item be dimensionless, else one is placed in the position of adding feet to pounds, a situation whose result is somewhat difficult to interpret. We choose, therefore, to expand our concept of weights in (121) and write

*Again, some care must be exercised in solving the system of 13 equations for the 13 new coefficient values because the state space, being nearly flat, leads inevitably to a relatively ill-conditioned matrix. The technique described with the program user instructions later in this report was found, after some experimentation, to be effective with a limited number of test cases. It may not be as effective in all cases, however.

$$D_1 = \frac{d_1}{h_{max}^2} \qquad D_4 = \frac{d_4}{W_{max}^2}$$

$$D_2 = \frac{d_2}{\gamma_{max}^2} \qquad D_5 = \frac{d_5}{E_{max}^2}$$

$$D_3 = \frac{d_3}{\dot{\gamma}_{max}^2} \qquad D_6 = \frac{d_6}{\alpha_{max}^2}, \tag{122}$$

where the lower case d's are now dimensionless numbers which can serve the purpose of altering the importance of the variables with respect to one another. Normally, we take the d's = 1.0.

Additionally, we note the importance of updating, by (108), the specific fuel consumption, c, after each iteration. Given a set of power coefficients and the velocity time history, c uniquely determines W_j. The weight at each point has a relatively important effect on the values of α, γ, and ρ which are determined by the integration procedure.

One way to restrict the range of the individual coefficient values produced by the Newton-Raphson identifier to physically realizable values is to include a priori values of the coefficients in the cost function. These values, obtained from previous flight or wind tunnel tests, can be used to influence the values extracted from the current flight test data. Inclusion of these values is simply another way, as Iliff and Taylor (Ref. 15) point out, of "making use of all the information available to obtain the estimates and insuring that no change is made in the (coefficient value) unless there is sufficient information in the flight data." To effect this step, we add the terms

$$\frac{d_7}{P_{0_m}^2}(P_{0_m} - P_0)^2$$

$$\frac{d_8}{P_{1_m}^2}(P_{1_m} - P_1)^2 \tag{123}$$

$$\vdots$$

$$\frac{d_{19}}{(CLAX_m)^2}(CLAX_m - CLAX)^2$$

to those inside the brackets of J_2. Here, the subscript "m" refers to the a priori values. Then the additional partial derivatives are given by

$$\begin{matrix} \frac{2d_7}{P_{0_m}^2}(P_{0_m} - P_0) \\ \vdots \\ \frac{2d_{19}}{(CLAX_m)^2}(CLAX_m - CLAX) \end{matrix} , \qquad (124)$$

and the additional second partial derivatives by

$$\begin{matrix} \frac{2d_7}{P_{0_m}^2} \\ \vdots \\ \frac{2d_{19}}{(CLAX_m)^2} \end{matrix} . \qquad (125)$$

The revised matrix equation for the coefficients is then obtained by adding (124) to the appropriate elements of the existing B matrix and (125) to the appropriate diagonal elements of the A matrix. As an initial estimate we take each lower case d, d_7 .... d_{19}, as ten times the coefficient value squared if we have a reasonable estimate of the correct coefficient values, and 0 if we do not.

Finally, for convenience of reference, the complete form of the matrix equation developed from (121), (124), and (125) is given below:

$$\begin{bmatrix} \Delta P_0 \\ \Delta P_1 \\ \Delta P_2 \\ \Delta P_3 \\ \Delta P_4 \\ \Delta C_{D_0} \\ \Delta C_{D_1} \\ \Delta C_{D_2} \\ \Delta C_{D_3} \\ \Delta C_{D_4} \\ \Delta C_{L_{A_0}} \\ \Delta C_{L_A} \\ \Delta C_{L_{A_X}} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} & a_{17} & a_{18} & a_{19} & a_{110} & a_{111} & a_{112} & a_{113} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} & a_{27} & a_{28} & a_{29} & a_{210} & a_{211} & a_{212} & a_{213} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} & a_{37} & a_{38} & a_{39} & a_{310} & a_{311} & a_{312} & a_{313} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} & a_{47} & a_{48} & a_{49} & a_{410} & a_{411} & a_{412} & a_{413} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} & a_{57} & a_{58} & a_{59} & a_{510} & a_{511} & a_{512} & a_{513} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & a_{67} & a_{68} & a_{69} & a_{610} & a_{611} & a_{612} & a_{613} \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} & a_{78} & a_{79} & a_{710} & a_{711} & a_{712} & a_{713} \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & a_{88} & a_{89} & a_{810} & a_{811} & a_{812} & a_{813} \\ a_{91} & a_{92} & a_{93} & a_{94} & a_{95} & a_{96} & a_{97} & a_{98} & a_{99} & a_{910} & a_{911} & a_{912} & a_{913} \\ a_{101} & a_{102} & a_{103} & a_{104} & a_{105} & a_{106} & a_{107} & a_{108} & a_{109} & a_{1010} & a_{1011} & a_{1012} & a_{1013} \\ a_{111} & a_{112} & a_{113} & a_{114} & a_{115} & a_{116} & a_{117} & a_{118} & a_{119} & a_{1110} & a_{1111} & a_{1112} & a_{1113} \\ a_{121} & a_{122} & a_{123} & a_{124} & a_{125} & a_{126} & a_{127} & a_{128} & a_{129} & a_{1210} & a_{1211} & a_{1212} & a_{1213} \\ a_{131} & a_{132} & a_{133} & a_{134} & a_{135} & a_{136} & a_{137} & a_{138} & a_{139} & a_{1310} & a_{1311} & a_{1312} & a_{1313} \end{bmatrix}^{-1} \bullet \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \\ b_6 \\ b_7 \\ b_8 \\ b_9 \\ b_{10} \\ b_{11} \\ b_{12} \\ b_{13} \end{bmatrix} \quad (126)$$

where

$$a_{11} = \frac{2d_1}{h_{max}^2} \sum_{i=1}^{N} \frac{\partial h_{t_i}}{\partial P_0} \frac{\partial h_{t_i}}{\partial P_0} + \frac{2d_2}{\gamma_{max}^2} \sum_{i=1}^{N} \frac{\partial \gamma_{t_i}}{\partial P_0} \frac{\partial \gamma_{t_i}}{\partial P_0} + \frac{2d_3}{\dot{\gamma}_{max}^2} \sum_{i=1}^{N} \frac{\partial \dot{\gamma}_{t_i}}{\partial P_0} \frac{\partial \dot{\gamma}_{t_i}}{\partial P_0}$$

$$+ \frac{2d_4}{W_{max}^2} \sum_{i=1}^{N} \frac{\partial W_{t_i}}{\partial P_0} \frac{\partial W_{t_i}}{\partial P_0} + \frac{2d_5}{E_{max}^2} \sum_{i=1}^{N} \frac{\partial E_{t_i}}{\partial P_0} \frac{\partial E_{t_i}}{\partial P_0} + \frac{2d_6}{\alpha_{max}^2} \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial P_0} \frac{\partial \alpha_{t_i}}{\partial P_0} + \frac{2d_7}{P_{0_m}^2}$$

$$+ \frac{2d_2}{\gamma_{max}^2} \sum_{i=1}^{N} (\gamma_{m_i} - \gamma_{t_i}) \frac{\partial^2 \gamma_{t_i}}{\partial P_0^2} + \frac{2d_3}{\dot{\gamma}_{max}^2} \sum_{i=1}^{N} (\dot{\gamma}_{m_i} - \dot{\gamma}_{t_i}) \frac{\partial^2 \dot{\gamma}_{t_i}}{\partial P_0^2}$$

$$+ \frac{2d_1}{h_{max}^2} \sum_{i=1}^{N} (h_{m_i} - h_{t_i}) \frac{\partial^2 h_{t_i}}{\partial P_0^2} \qquad (127)$$

is a typical diagonal element and

$$a_{12} = \frac{2d_1}{h_{max}^2} \sum_{i=1}^{N} \frac{\partial h_{t_i}}{\partial P_0} \frac{\partial h_{t_i}}{\partial P_1} + \frac{2d_2}{\gamma_{max}^2} \sum_{i=1}^{N} \frac{\partial \gamma_{t_i}}{\partial P_0} \frac{\partial \gamma_{t_i}}{\partial P_1} + \frac{2d_3}{\dot{\gamma}_{max}^2} \sum_{i=1}^{N} \frac{\partial \dot{\gamma}_{t_i}}{\partial P_0} \frac{\partial \dot{\gamma}_{t_i}}{\partial P_1}$$

$$+ \frac{2d_4}{W_{max}^2} \sum_{i=1}^{N} \frac{\partial W_{t_i}}{\partial P_0} \frac{\partial W_{t_i}}{\partial P_1} + \frac{2d_5}{E_{max}^2} \sum_{i=1}^{N} \frac{\partial E_{t_i}}{\partial P_0} \frac{\partial E_{t_i}}{\partial P_1} + \frac{2d_6}{\alpha_{max}^2} \sum_{i=1}^{N} \frac{\partial \alpha_{t_i}}{\partial P_0} \frac{\partial \alpha_{t_i}}{\partial P_1}$$

$$+ \frac{2d_2}{\gamma_{max}^2} \sum_{i=1}^{N} (\gamma_{m_i} - \gamma_{t_i}) \frac{\partial^2 \gamma_{t_i}}{\partial P_0 \partial P_1} + \frac{2d_3}{\dot{\gamma}_{max}} \sum_{i=1}^{N} (\dot{\gamma}_{m_i} - \dot{\gamma}_{t_i}) \frac{\partial^2 \dot{\gamma}_{t_i}}{\partial P_0 \partial P_1}$$

$$+ \frac{2d_1}{h_{max}^2} \sum_{i=1}^{N} (h_{m_i} - h_{t_i}) \frac{\partial^2 h_{t_i}}{\partial P_0 \partial P_1} \qquad (128)$$

is a typical off-diagonal element of the A matrix;

$$b_1 = \frac{2d_1}{h_{max}^2} \sum_{i=1}^{N} (h_{m_i} - h_{t_i}) \frac{\partial h_{t_i}}{\partial P_0} + \frac{2d_2}{\gamma_{max}^2} \sum_{i=1}^{N} (\gamma_{m_i} - \gamma_{t_i}) \frac{\partial \gamma_{t_i}}{\partial P_0}$$

$$+ \frac{2d_3}{\dot{\gamma}_{max}^2} \sum_{i=1}^{N} (\dot{\gamma}_{m_i} - \dot{\gamma}_{t_i}) \frac{\partial \dot{\gamma}_{t_i}}{\partial P_0} + \frac{2d_4}{W_{max}^2} \sum_{i=1}^{N} (W_{m_i} - W_{t_i}) \frac{\partial W_{t_i}}{\partial P_0} \qquad (129)$$

$$+ \frac{2d_5}{E_{max}^2} \sum_{i=1}^{N} (E_{m_i} - E_{t_i}) \frac{\partial E_{t_i}}{\partial P_0} + \frac{2d_6}{\alpha_{max}^2} \sum_{i=1}^{N} (\alpha_{m_i} - \alpha_{t_i}) \frac{\partial \alpha_{t_i}}{\partial P_0} + \frac{2d_7}{P_{0_m}^2} (P_{0_m} - P_0)$$

is a typical element of the B matrix. Note that the number of elements depends upon the number of unknown coefficients. For example, for 9 unknown coefficients, the A matrix has 81 elements and the B matrix has 9 elements. Note also that some of the partials do not exist, i.e., $\frac{\partial \alpha}{\partial P}$, $\frac{\partial W}{\partial C_L}$, etc. Some of the second partial derivatives, e.g. those involving E and W, also do not exist. Second partial derivatives involving α are omitted; since the first partials must be evaluated numerically, there is no straightforward way to obtain the second partials at the same time. In addition, in an effort to speed convergence, tolerances are set on all differences, $(\alpha_{m_i} - \alpha_{t_i})$ etc. When this difference is less than the established tolerance, the difference is set to zero. Since α_{m_i} for the test cases was known to contain some error, the tolerance for $(\alpha_{m_i} - \alpha_{t_i})$ was set at 6×10^{-5} radians. At this value the α-differences at each value of i became zero. No second partial derivative values are then necessary.

APPLICATION OF CONSTRAINTS TO MINIMIZATION OF COST FUNCTION

The parameter space described by these equations is nearly flat and has many local minima. As a result, repeated application of (126) usually leads to one of these local minima rather than to the global minimum. To find the global minimum two additional procedures are applied. The first is to constrain the recovered parameter values to lie between certain limits. For example, one would not expect an aircraft with a relatively low power

loading like the ATLIT to have a C_{L_α} flaps up of more than 6.3. Similarly, the CLAX term, if it has a value, is not likely to be positive. The CLAO term will usually lie between -0.5 and +0.5. One can usually assign reasonable upper and lower limits to the other parameter values on the basis of wind tunnel tests, analysis, or previous experience. The parameter values can be constrained to lie within these limits by comparing the parameter values obtained after performing the operation described in (126) with the limits and adding a term

$$\text{WGTL}(P_0 - P_{0_{\text{lower limit}}}) \tag{130}$$

to the b_1 element and the term

$$\text{WGTL} \tag{131}$$

to the a_{11} element in (126) if $P_0 < P_{0_{\text{lower limit}}}$. Similarly if $P_0 > P_{0_{\text{upper limit}}}$ one adds

$$\text{WGTU}(P_0 - P_{0_{\text{upper limit}}}) \tag{132}$$

to the b_1 element and

$$\text{WGTU} \tag{133}$$

to the a_{11} element. The matrix manipulation is again carried out and the new parameter values are compared with the imposed limits. If any of the parameter values still does not lie within the limiting values, WGTU or WGTL, whichever is appropriate, is increased by a factor of 10 for that parameter and the matrix operation repeated.

While this operation will prevent parameter values from being grossly ridiculous in the physical sense, it does not insure convergence to a global minimum. There are two reasons:

1. The limits will almost always be chosen independently of one another and may in fact lie on different slopes of a local minima. Thus, the parameter values may not readily move off these limits if the weights, WGTL and WGTU, are reduced on subsequent iterations.

2. A number of the diagonal elements of the A matrix are much smaller than the off-diagonal elements in the same column or row. Such ill-conditioning can lead to relatively large excursions in some of the parameter values from iteration to iteration. These excursions may actually be large enough to cause the parameter value to move from one limit to the other in one iteration. Since the trajectory is very sensitive to the parameter values used to compute it, large changes in parameter values cannot be used to find the global minimum because the computed trajectory will cross the input trajectory on each iteration; the cost function increases very rapidly in these circumstances.

Two means have been found useful for conditioning the A matrix to alleviate this problem. The first method sets the off-diagonal elements, a_{12}, a_{13}, $\cdots$ a_{113}, a_{21}, a_{31}, $\cdots$ a_{131}, to zero and retains only a_{11}. This is equivalent to saying that any changes in P_0 do not depend upon the values of the other parameters nor do the other parameters depend upon P_0; changes in P_0 depend only on the agreement between the computed and measured trajectories. This is not as preposterous as it may at first appear. Consider the physical situation: All of the data on which the procedure operates is at a speed considerably above V = 0, the speed at which the power equals P_0. P_0, for the example cases at least, is much smaller (about a factor of 10) than the other terms in the power expression which also contributes to the ill-conditioning. Note, however, that the system can still converge to the global minimum when the off-diagonal elements are set to zero because $b_1 \to 0$ as the global minimum is approached.

The second method for improving the conditioning of the A matrix starts by extracting the power coefficients from both the drag and the lift equations. If the system has not converged to a global minimum and produced compatible data trajectories, the power coefficients extracted by fitting the two equations to the same data will be different. Then by imposing a priori power coefficients of the type

$$\frac{G\, P_{0_{DRAG}}^2}{(G-1)P_{0_{DRAG}} + P_{0_{LIFT}}} \qquad (134)$$

and supplying these with moderate weights, one can condition the system to converge reasonably rapidly to a new minimum. This will usually be much closer to the global minimum than the previous one. Then, by relaxing the weights on the a priori values somewhat, the system may adjust itself even closer to the global minimum. In (134) $P_{0_{DRAG}}$ is the P_0 coefficient extracted from the drag or $\dot{V}$ equation, $P_{0_{LIFT}}$ is the P_0 coefficient extracted from the lift or $\dot{\gamma}$ equation, and G is an arbitrarily-selected constant. G should be about 10 for the higher order coefficients and about 100 for P_0.

This is to account for the fact that because power is a small term in the $\dot{\gamma}$ equation, the parameter values from this equation will be more in error than those from the $\dot{V}$ equation. The correct a priori values should therefore lie closer to the parameter values derived from the $\dot{V}$ equation. The reason this procedure is effective is that when power is specified the system is actually determinant* at every speed; thus, specifying a priori values for the power coefficients will cause the system to converge fairly rapidly to some minimum. If the a priori values are exact, the lift and drag parameter values will be recovered with good accuracy but not exactly. The trick then is to choose G properly, use the first method, or develop some combination technique. Unfortunately, experience in working with the system is necessary in order to select the best approach. This situation, it may be mentioned, is not uncommon in parameter identification work at the present time.

If the a priori technique represented by equation (134) and its subsequent relaxations is permitted to go through a number of iterations one finds, not surprisingly, that the changes in the coefficient values get smaller and smaller each iteration. To permit this situation to continue beyond a certain point is (a) not cost-effective and (b) does not guarantee convergence of the coefficients to exact values. To aid computationally in the convergence to at least a local minimum those coefficients which do not change at least 1.5×10^{-6} times their value are "frozen" and the system reduced accordingly. CLA, however, is treated differently. When $\Delta CLA/CLA < 1.5 \times 10^{-6}$ but still positive, CLA is increased by 1.0×10^{-3}. This is done because it was found that CLA is the key parameter in determining which local minimum the system converges to. Near the correct value of CLA the state space must be very flat because the system will converge** to a very small cost function for <u>any</u> value of CLA. This value of the cost function will be very slightly greater than the global minimum so that the prospects for reaching the global minimum without some "nudging" of this kind are quite remote.

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* That is to say the total lift or total drag are determinate. The individual coefficients in the polynomial expansions for lift and drag must still be found as before.

** By converge we mean reach a value from which it will not differ significantly despite numerous additional iterations.

EXAMPLE APPLICATION OF NOISE REDUCTION AND NEWTON-RAPHSON PROCEDURE

The efficacy of the foregoing procedures is indicated by the following example: If only the α-channel of the theoretical data set is degraded by 1% α_{max} random noise and then filtered with $n_c = 10$, errors remaining in α are still on the order of 2×10^{-3} radians. When this computed data set is submitted to the least squares coefficient extraction procedure, the fit error obtained for the correct model is 0.294823×10^{-4} and the six coefficients are:

$P_0 = 49398.169$ $\quad C_{D_0} = .0440371829$

$P_2 = 857.520129$ $\quad C_{D_2} = 1.390709638$

$P_3 = -1.005276788$ $\quad C_{D_4} = 1947.263799$

The α-bias error found ($-.111455 \times 10^{-8}$) is too small to justify a correction.

When the data are fit with a power model of $P_0 V^{1/3}$ and a five term drag model the fit error is $0.11828259 \times 10^{-3}$. When the drag model is changed to $C_D = C_{D_0} + C_{D_1} C_L^2$ the fit error becomes $0.30286167 \times 10^{-3}$ and the coefficients are

$P_0 = 31825.6829$

$C_{D_0} = .036226989$

$C_{D_1} = .0932119$

The program then uses a least-square distance routine to fit the α-data to the C_L values found from the $\dot{\gamma}$-equation with the following result:

$$C_L = -0.002163327 + 6.35788976\alpha - 0.3823769\alpha^2$$

The individual α points are then moved to satisfy this equation.

When the coefficient extraction is repeated, the fit error for the correct model is now reduced to 0.1846867×10^{-6} and the coefficients are

$P_0 = 25354.595$ $\quad C_{D_0} = .03342$

$P_2 = 1173.542$ $\quad C_{D_2} = 1.29939516$

$P_3 = 2.377407$ $\quad C_{D_4} = 2005.55596$

The C_L coefficients are then updated with the result that

$$C_L = - 0.0017838557 + 6.34847\alpha - 0.310849\alpha^{2.0304627}$$

After 4 iterations of the α-modification procedure discussed in section 3 above, the minimum fit error for the correct model is 0.33751×10^{-7} and the coefficients are

$P_0 = 26881.7756$ $\quad C_{D_0} = .033792832$

$P_2 = 1156.25239$ $\quad C_{D_2} = 1.2885474567$

$P_3 = -2.3179596$ $\quad C_{D_4} = 2017.21169779$

The lift coefficient equation has then become

$$C_L = - .001782573568 + 6.34888117\alpha - 0.3160536\alpha^{2.04393}$$

The trajectory comparison procedure yields a fit error of 0.15515×10^{-8} with the following coefficients:

$P_0 = 28740.475$ $\quad C_{D_0} = .03503665$

$P_2 = 1127.26152$ $\quad C_{D_2} = 1.3017466$

$P_3 = -2.17339$ $\quad C_{D_4} = 1991.91279$

It is at this point that the Newton-Raphson identifier is first applied. Using the foregoing coefficients and the latest value for the specific fuel consumption, we compute differences between the "measured" values and the latest calculated values of the variables along the flight trajectory as well as the values of the partial derivatives at each point. When these are properly summed and placed in the appropriate A and B matrices, we solve the system of equations to find the quantities by which the coefficients should be changed to reduce the difference between the "measured" trajectory and the computed trajectory. The new coefficients found by eight iterations of this procedure are then

$P_0 = 28735.87794$ $\quad C_{D_0} = .03510029979$ $\quad CLAO = .254462293 \times 10^{-7}$

$P_2 = 1126.60939679$ $\quad C_{D_2} = 1.28590$ $\quad CLA = 6.29327993$

$P_3 = -2.1696485666$ $\quad C_{D_4} = 2016.338978$ $\quad CLAX = -.301975855 \times 10^{-8}$

When these, along with a revised specific fuel consumption, are used in the subsequent trajectory computation, the fit error is less than 6×10^{-12}. Tables V and VI show the results achieved after 29 iterations. The fit error at this point is 1.3336×10^{-13} and the residual error in α averages about 1.2×10^{-5} radians. Additional iterations may be used until the final fit error of 6.553×10^{-14} — the value obtained with time histories computed from the correct theoretical coefficients — is approached. Note that in these circumstances the average residual error in α is less than 0.6928×10^{-5} radians, or about one part in 100,000. There is evidence to suggest, however, that most of this error is a result of the use of only 16 decimal digits in the integration routine. In that event, users with an extended precision capability should find the ultimate fit error to be somewhat lower ($\sim 10^{-22}$).

The example cited here shows that with flight data that are not excessively noisy or otherwise erroneous, the simple least squares procedure described earlier in this report can be extended and modified to accommodate such errors successfully and still produce reliable coefficient values. In the present case the reduction in fit error was more than eight orders of magnitude.

When this more powerful procedure was first applied to actual flight data, however, the initial fit error was about 10^{-1} (about 1000 times as large as for the test case) and no reduction could be obtained. Examination of the input data revealed that the α, θ, and $\sin^{-1}(\dot{h}/V)$ data were very incompatible. It was immediately obvious that it would be necessary to reduce this incompatibility in some rational fashion before the procedure described above could begin to function effectively.

TABLE V. EFFECT OF NOISE REDUCTION EFFORTS ON RANDOM NOISE-CORRUPTED α-DATA (OTHER CHANNELS NOISE FREE)

Pt.	α-values after smoothing by low-pass filter	α-values after application of noise-reduction program	Theoretical α-values
1	.1648561	.162610	.1625865
6	.1646336	.162650	.1626264
11	.1642220	.162726	.1627021
16	.1635306	.162858	.1628342
21	.1627125	.163017	.1629993
26	.1622586	.163060	.1630357
31	.1621283	.162896	.1628721
36	.1620319	.162473	.1624490
41	.1617028	.161753	.1617295
46	.1609460	.160710	.1606867
51	.1596614	.159317	.1592940
56	.1578413	.157549	.1572621
61	.1555447	.155404	.1553815
66	.1528620	.152898	.1528759
71	.1498808	.150048	.1500260
76	.1466639	.146872	.1468503
81	.1432434	.143406	.1433850
86	.1396289	.139697	.1396771
91	.1358230	.135794	.1357737
96	.1318381	.131741	.1317222
101	.1277057	.127589	.1275701
106	.1234775	.123383	.1233655
111	.1192182	.119174	.1191564
116	.1149943	.115007	.1149901
121	.1108633	.110919	.1109024
126	.1068668	.106936	.1069206
131	.1030291	.103087	.1030717
136	.0993605	.0993959	.0993814
141	.0958635	.0958769	.0958629
146	.0925384	.0925358	.0925223
151	.0896943	.0896856	.0896724
156	.0867033	.0866978	.0866851
161	.0838952	.0838976	.0838853
166	.0812729	.0812796	.0812676
171	.0788341	.0788380	.0788264
176	.0765706	.0765671	.0765559
181	.0744685	.0744597	.0744487
186	.0725120	.0725069	.0724962
191	.0706878	.0707004	.0706899
196	.0689884	.0690313	.0690211

TABLE V. (Continued)

Pt.	α-values after smoothing by low-pass filter	α-values after application of noise-reduction program	Theoretical α-values
201	.0674143	.0674917	.0674817
206	.0659714	.0660735	.0660637
211	.0646669	.0647690	.0647594
216	.0635016	.0635702	.0635607
221	.0624647	.0624701	.0624609
226	.0615312	.0614627	.0614536
231	.0606668	.0605417	.0605327
236	.0598368	.0597010	.0596921
241	.0590192	.0589354	.0589267
246	.0582159	.0582405	.0582318
251	.0574569	.0576115	.0576030
256	.0567929	.0570441	.0570357
261	.0562780	.0565344	.0565260
266	.0559444	.0560788	.0560705
271	.0557777	.0556742	.0556659
276	.0557012	.0553170	.0553088
281	.0555776	.0550045	.0549963
286	.0552280	.0547339	.0547258
291	.0544669	.0545027	.0544945
296	.0531435	.0543080	.0543000
298	.0524357	.0542399	.0542318

Fit error = 1.3336×10^{-13}

TABLE VI. COEFFICIENT VALUES OBTAINED WITH NOISE REDUCTION PROCEDURE

	Theoretical values used to generate data time histories	Values retrieved from noise reduction procedure
P_0	28,735.71427	28,738.72144
P_1	1,126.60714	1,126.5699
P_2	- 2.169642857	- 2.1694849
C_{D_0}	0.035100000	0.03510121
C_{D_1}	0	
C_{D_2}	1.289155014	1.2887796
C_{D_3}	0	
C_{D_4}	2,030.800865	2,028.977898

A PRIORI IMPROVEMENT OF DATA COMPATIBILITY

A diligent investigation into the sources of α, θ, and γ incompatibility in the flight data revealed the possibility of at least the following sources of error in the individual data channels which had not been treated earlier:

1. alignment errors in the installation of the α and θ transducers
2. a bias error in the pitch rate gyro indication
3. a drift in the pitch angle indication
4. excessive lag or other dynamic effects in the pneumatic altitude and airspeed indications
5. gain and bias errors in the pressure instrument calibrations and in the position error calibrations
6. a phase lead in the θ and temperature indications relative to the other channels

It will be appreciated that many of these effects are not readily quantified in the usual calibration procedures. To make the flight data sufficiently self-compatible to be usable in the lift, drag, and power extraction routine, the filtered input measurements were altered as follows:

1. A bias, calculated from

$$\theta_b = \sin^{-1}\left(\frac{Ax_N}{g}\right) - \theta_N \,, \tag{135}$$

was added to the input θ data. The subscript N refers to the last data value in the set.

2. A bias, calculated from

$$\dot{\theta}_b = \frac{\theta_N - \int_1^T \dot{\theta}\, dt - \theta_1}{T} \,, \tag{136}$$

was added to the input $\dot{\theta}$ data. As a result of these steps the Ax, θ, and $\dot{\theta}$ traces were found to be quite self-consistent. If the time integral of $\dot{\theta}$ did not then match $\theta(t)$,

3. The phase lead of θ with respect to the other data channels was found by determining the value of τ which maximizes

$$\sum_{i=1}^{N} \left\{ \theta_i * \left[\int_1^i \dot{\theta}(i - \tau)\, di + \theta_1 \right] \right\} . \tag{137}$$

The phase lead was eliminated by dropping τ data points from the beginning of each data trace <u>except</u> θ and temperature.

The opportunity to determine the compatibility of the pneumatic data (V and h) with the inertial data and the angle of attack follows from the kinematic equation for the longitudinal body axis acceleration and the definition of rate of climb:

$$Ax = \dot{V} \cos \alpha + V(\dot{\theta} - \dot{\alpha}) \sin \alpha + g \sin \theta - X_{ax} \dot{\theta}^2 \qquad (138)$$

$$h_i = \int_1^i V \sin (\theta - \alpha) \, dt + h_1 \, . \qquad (139)$$

Examination of the first equation will show that if one assumes that as a result of 1, 2, and 3 above Ax, θ, and $\dot{\theta}$ are now correct and compatible among themselves, a compatible value for either V or α can be found by solving a differential equation assuming the other variable to be correct. If one assumes that α is correct then a compatible value of V(t) is the solution of the equation

$$\dot{V}_j = \left[\frac{Ax_j - g \sin \theta_j + X_{ax} \dot{\theta}_j^2}{\cos \alpha_j} \right] - V_j(\dot{\theta}_j - \dot{\alpha}_j) \tan \alpha_j \qquad (140)$$

with the initial condition $V_1 = V_1$ from pneumatic data at the first data point.

This solution is obtained quite readily by the technique described earlier to integrate the trajectory equations (112).

If, on the other hand, V is assumed to be the error-free variable, α can be determined by a slight variation of the same solution procedure. To obtain the proper form one first makes the substitution

$$u = \cos \alpha \qquad (141)$$

whence (138) can be written

$$\dot{u}_j = \left[\frac{Ax_j - g \sin \theta_j + X_{ax} \dot{\theta}_j^2}{V_j} \right] - \left[\frac{\dot{V}_j}{V_j} \right] u_j - \dot{\theta}_j S_j \sqrt{1 - u_j^2} \qquad (142)$$

Here S_j has the value ± 1.0. The correct value is determined by the following logic:

a. choose as S_1 the value corresponding to the measured α_1. This value of α is also used to begin the integration.

b. If $S_j > 0$, $u_j > 0.9999$, and $\{-u_j/[S_j(\sqrt{1-u_j^2} + 10^{-12})]\} < 0$,

then the sign of S_j is changed for the next value of j.

c. The same is true if $S_j < 0$, $u_j > 0.9999$, and $\{-\dot{u}_j/[S_j(\sqrt{1-u_j^2} + 10^{-12})]\} > 0$.

The computed value of α at any point is then

$$\alpha_j = \sin^{-1} \{S_j \sqrt{1-u_j^2}\} . \tag{143}$$

An effort was made to calculate α in this manner but the solutions had ridiculously large magnitudes. Efforts were also made to apply gain and bias corrections to the velocity in an effort to improve the result. This too failed to produce physically reasonable results. The various lag constants were then varied over large ranges with the same end result. It was therefore concluded that the velocity and altitude data contained substantial errors, probably resulting from a combination of excessive lags, dynamic effects, and perhaps incorrect gains and biases. It was therefore necessary to assume that α was correct in order to solve for V.

The initial results were quite encouraging in that they were qualitatively similar to the input data but displayed quantitative differences of up to 20 ft/sec at certain times. It was found that this difference could be reduced significantly by assuming a drift in the pitch gyro indication of 8×10^{-4} rad/sec. Subtracting this "drift" from the input pitch angle indication led to a calculated velocity that usually differed from the input by less than 1.5 ft/sec. As a consequence of these findings

4. The input velocity was overwritten by the solution of (140) and

5. The input altitude was overwritten by

$$h(t) = \int_1^t V \sin (\theta - \alpha)\, dt + h_1 \tag{144}$$

where V is the result of the previous step. Comparisons of the calculated velocity and altitude with the input V and H data are shown for a typical pull-up-pushover in figure 39. Note that differences of this magnitude would make it impossible for the coefficient extraction procedure to operate successfully.

While the foregoing actions produce a reasonably compatible data set, they do not guarantee its accuracy. The reader is cautioned that while these data, when processed by the coefficient extraction program, will yield

physically reasonable numbers if the proper model is available, such results may not be the correct values for the particular aircraft under investigation. This could easily happen if errors in the α-channel, for example, are masked by the compatibility improvement scheme. Note also that the solution of (140) is not very sensitive to the exact value of gain and bias used for the α position error. Compare, for example, figure 39 with figure 40.

In an effort to fine-tune the data for improved compatibility before its submission to the coefficient extraction program, a number of other procedures were applied. The first represents γ by $\theta - \alpha$ and calculates $\dot{\gamma}$ from this by the method of splines. This value of $\dot{\gamma}$ is substituted into (138) now written as

$$Ax = \dot{V} \cos \alpha + V \dot{\gamma} \sin \alpha + g \sin \theta - X_{ax} \dot{\theta}^2 . \qquad (145)$$

Assuming that V, $\dot{V}$, θ, $\dot{\theta}$, $\dot{\gamma}$, and Ax are known, α is determined at each point by the second-order Newton-Raphson technique. The resulting α values are fit to the input α values using a second order polynomial:

$$\alpha_j = K_1 \alpha^2_{DATA_j} + K_2 \alpha_{DATA_j} + K_3 . \qquad (146)$$

α_{DATA_j} is then replaced by values computed from this equation. K_1, K_2, and K_3 are found by the method of least squares. Since α may now be slightly different, new values of γ are computed and fit to the previous values by

$$\gamma_j = K_4 \gamma^2_{j_{OLD}} + K_5 \gamma_{j_{OLD}} + K_6 \qquad (147)$$

with K_4, K_5, and K_6 determined in a least squares sense. The new values of γ are replaced by those computed from the equation.

A new $\dot{\gamma}$, defined as $2K_4 \gamma_{j_{OLD}} \dot{\gamma}_{j_{OLD}} + K_5 \dot{\gamma}_{j_{OLD}}$, is used to find new α's. The cycle is repeated a number of times until K_1 and $K_3 \to 0$ and $K_2 \to 1.0$ as closely as possible.

The final "tuning" assumes that bias errors may still be present in α and θ and that there may be a small residual acceleration sensitivity in the static pressure indication. The latter is important primarily in those cases where V is assumed to be correct and a compatible α must be calculated. It serves principally as a check when α is taken to be correct and a compatible V is calculated. For this final tuning we construct the cost function

$$J_3 = \sum_{j=1}^{N} \left[\frac{d_{20}}{P_{m_1}^2} (P_{m_j} - P_{c_j})^2 + \frac{d_{21}}{Ax_{max}^2} (Ax_{m_j} - Ax_{c_j})^2 + \frac{d_{22}}{A_m^2} (A_m - A)^2 \right.$$

$$\left. + \frac{d_{23}}{B_m^2} (B_m - B)^2 + \frac{d_{24}}{C_m^2} (C_m - C)^2 + \frac{d_{25}}{D_m^2} (D_m - D) + \frac{d_{26}}{G_m^2} (G_m - G)^2 \right] , \quad (148)$$

where $P_{c_j} = \frac{P_0}{T_0} T_j \left\{ 1 - 6.86 \times 10^{-5} \left[\int_1^{t_j} V_j \sin(\theta_j - \alpha_j) dt_j \right. \right.$

$$\left. \left. + G \int_1^{t_j} V_j \cos(\theta_j - \alpha_j) dt_j + h_1 \right] \right\}^{4.26} + A\dot{\theta}_j^2 + BAx_j + Cg\sin\theta_j \quad (149)$$

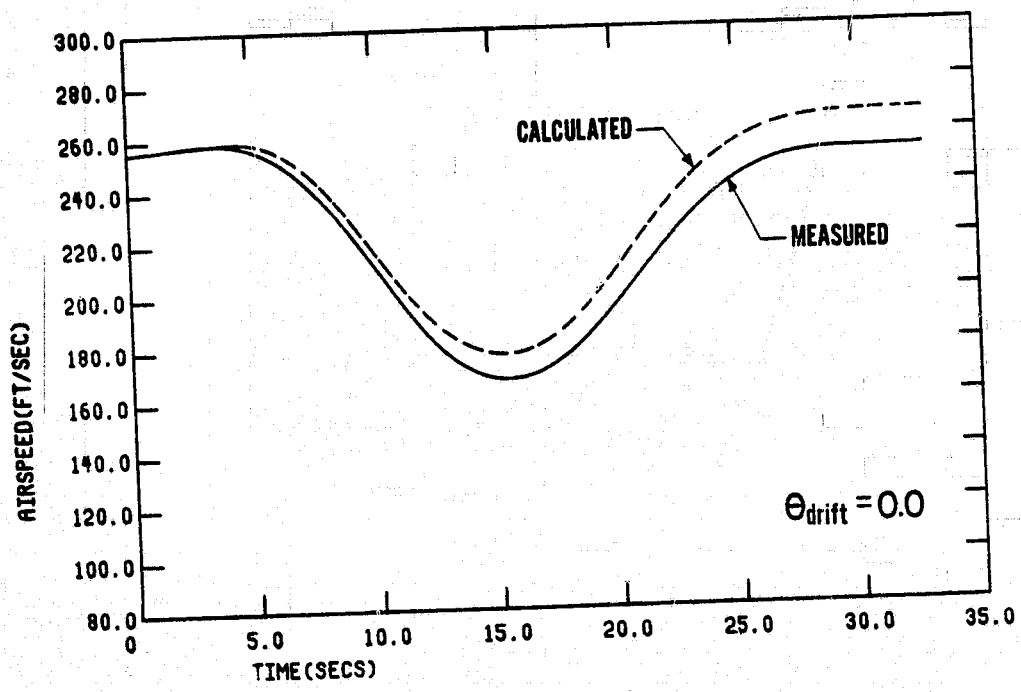
$$Ax_{c_j} = \dot{V}_j \cos\alpha_j + V_j(\dot{\theta}_j - \dot{\alpha}_j)\sin\alpha_j + X_{ax}\dot{\theta}_j^2 + D(V_j[\dot{\theta}_j - \dot{\alpha}_j]\cos\alpha_j$$

$$+ g\cos\theta_j - \dot{V}_j \sin\alpha_j) + G(\dot{V}_j \sin\alpha_j - V_j(\dot{\theta}_j - \dot{\alpha}_j)\cos\alpha_j) , \quad (150)$$

$$D = \theta_{bias} ,$$

$$G = \gamma_{bias} \text{ or } (\theta_{bias} - \alpha_{bias}) ; \quad \alpha_{bias} = D - G , \quad (151)$$

and minimize J_3 with respect to A, B, C, D, and G, using the Newton-Raphson procedure. With these values we apply bias corrections to θ and α and an "acceleration correction" to P_{m_j}. We then return to the beginning of the data processing activity, calculate new velocities, altitudes, and angles of attack, and again minimize J_3 with respect to A, B, C. D, and G. This procedure may be repeated until J_3 has in fact reached a minimum. A priori values may be included for the parameters if known. Even approximate a priori parameter values may be used to advantage during the processing of the first few data runs to insure reasonable results and easier detection of "bugs". Typical results for the ATLIT obtained by applying the entire calibration-filtering-compatibility improvement procedure (called FDR1) are shown in Appendix A.



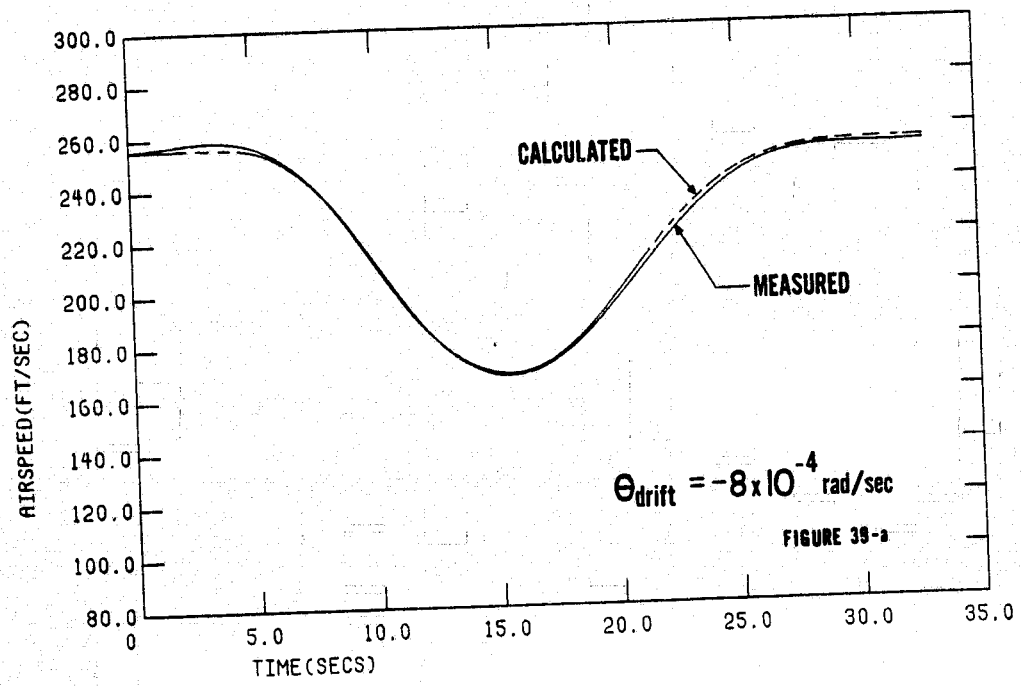
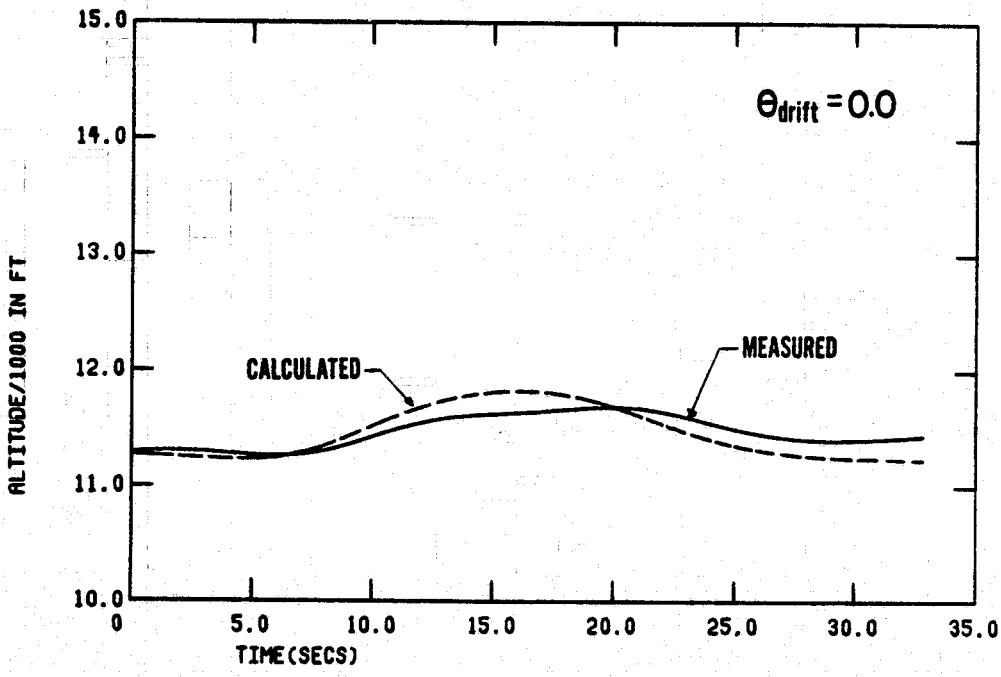
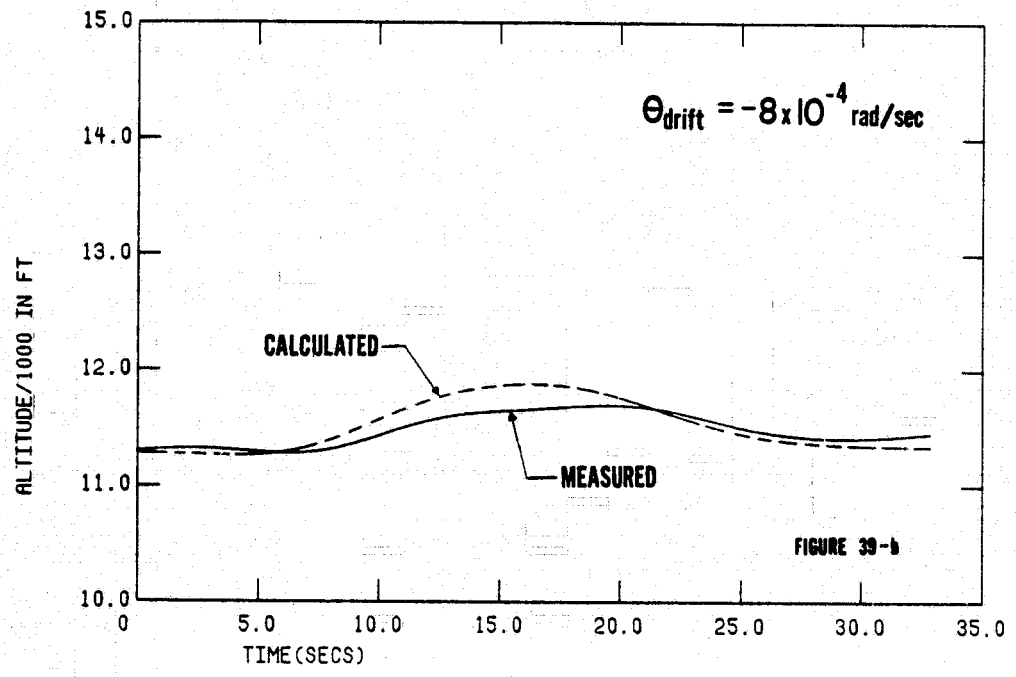


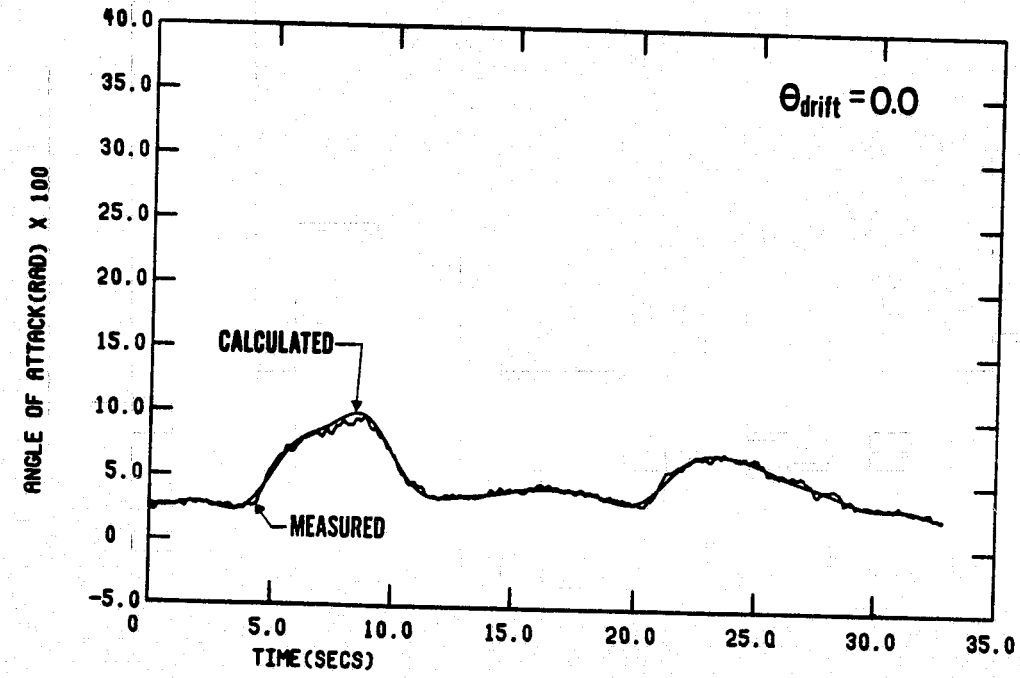
FIGURE 39-a

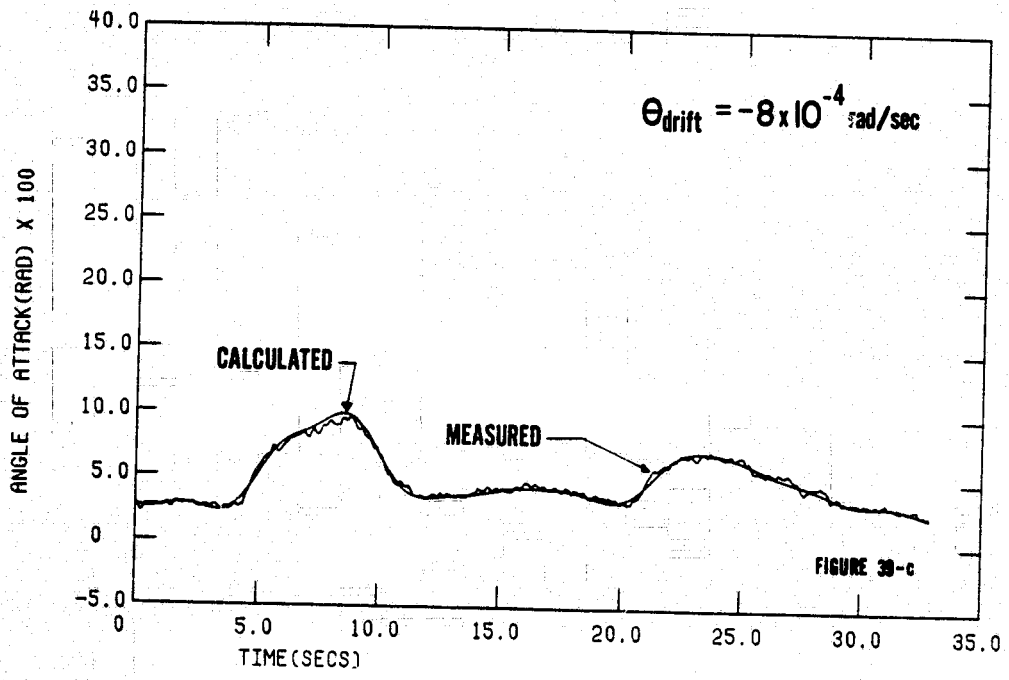
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



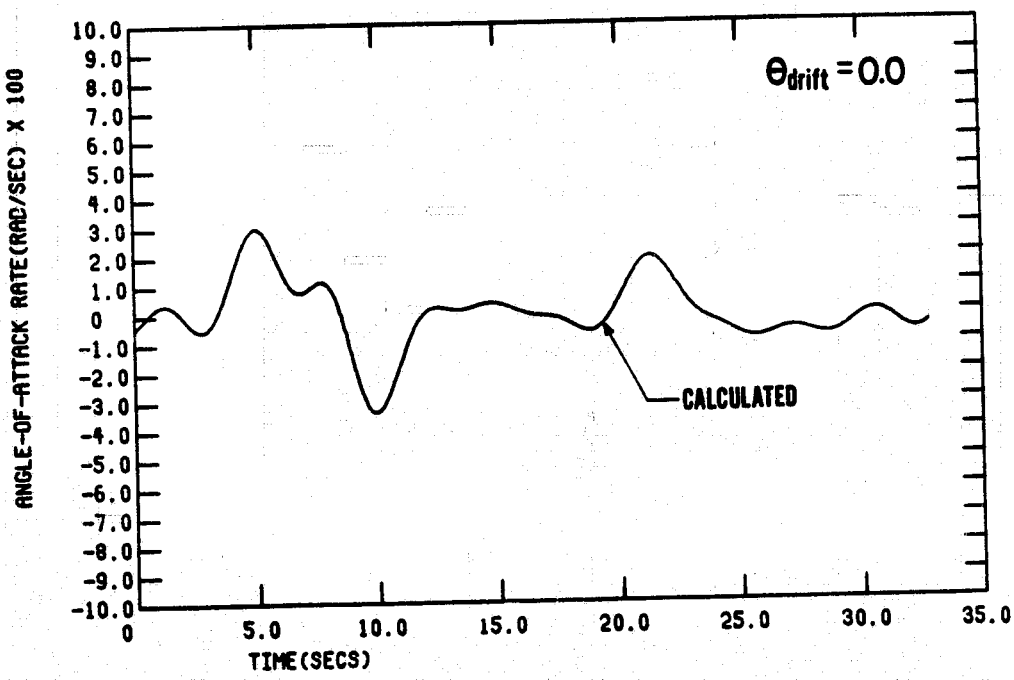


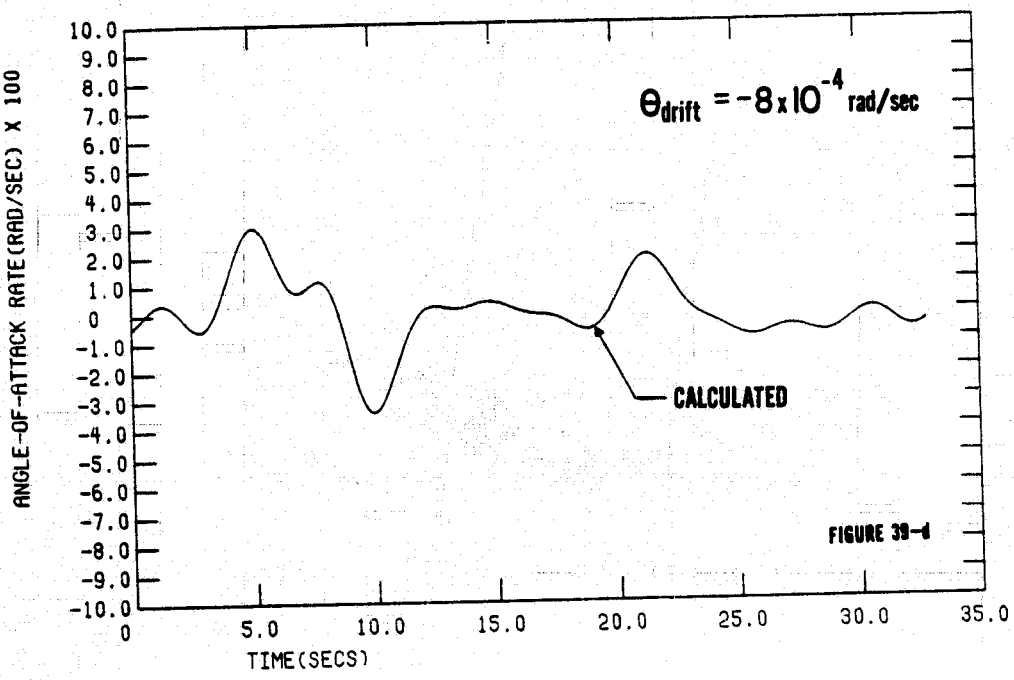
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



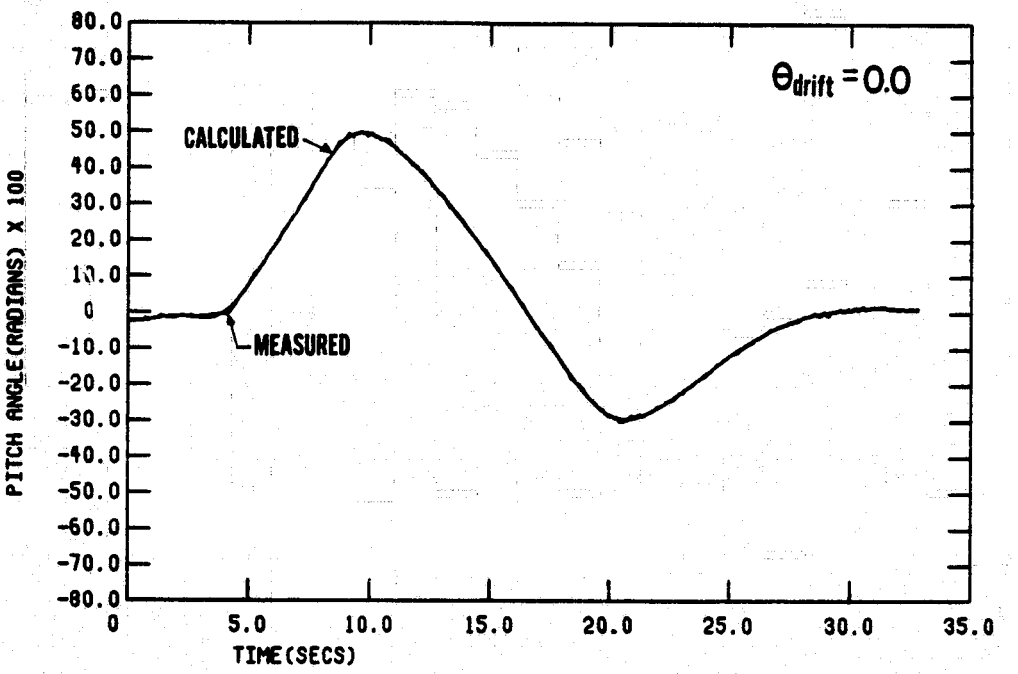


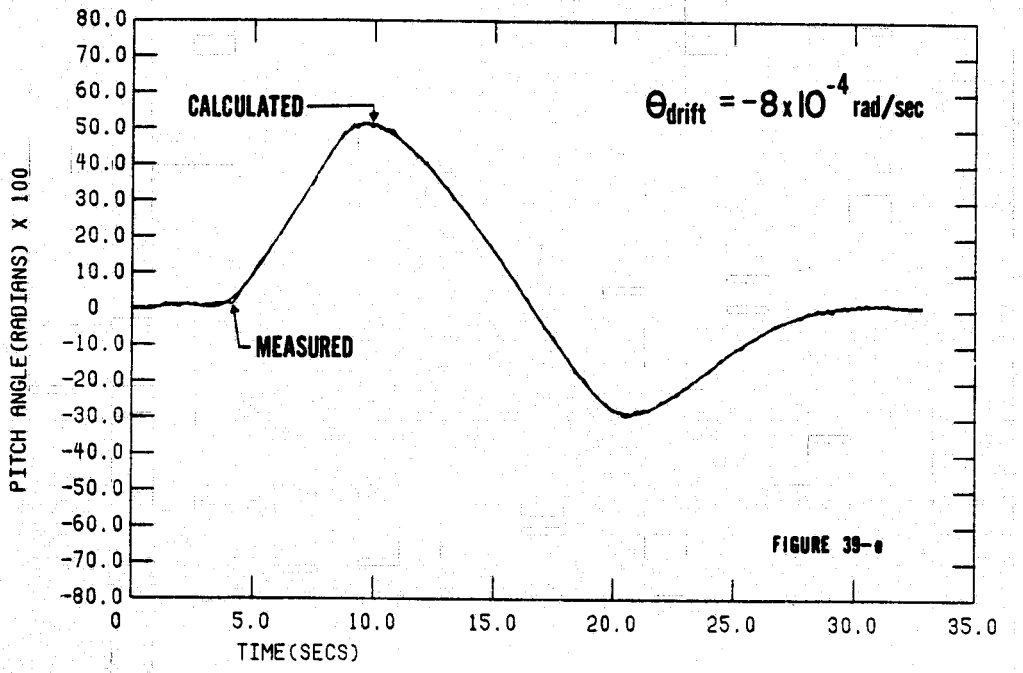
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



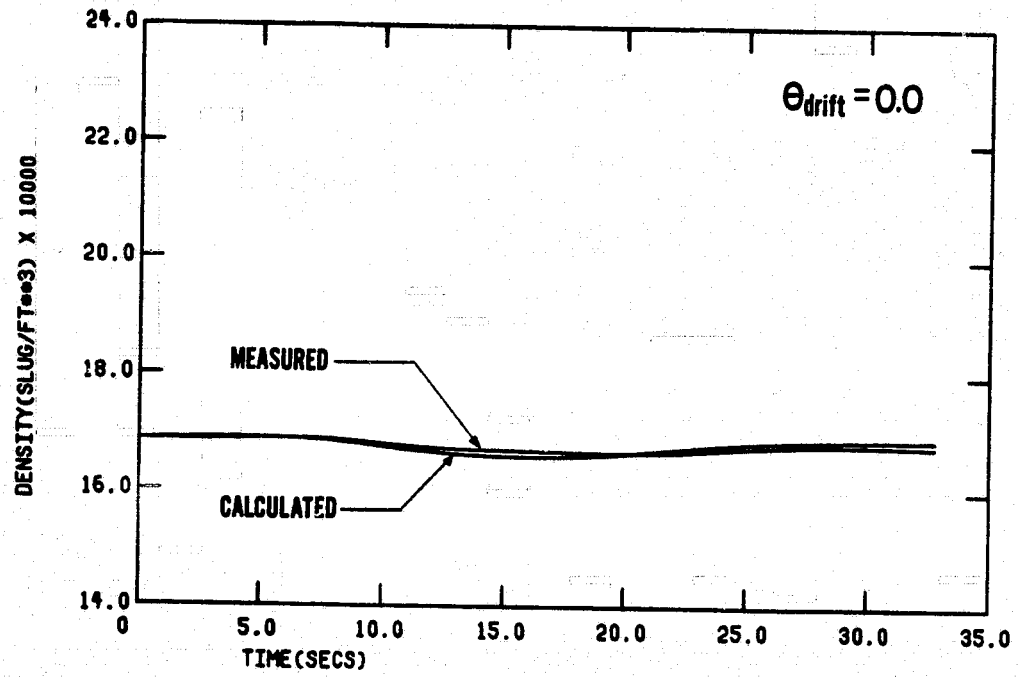


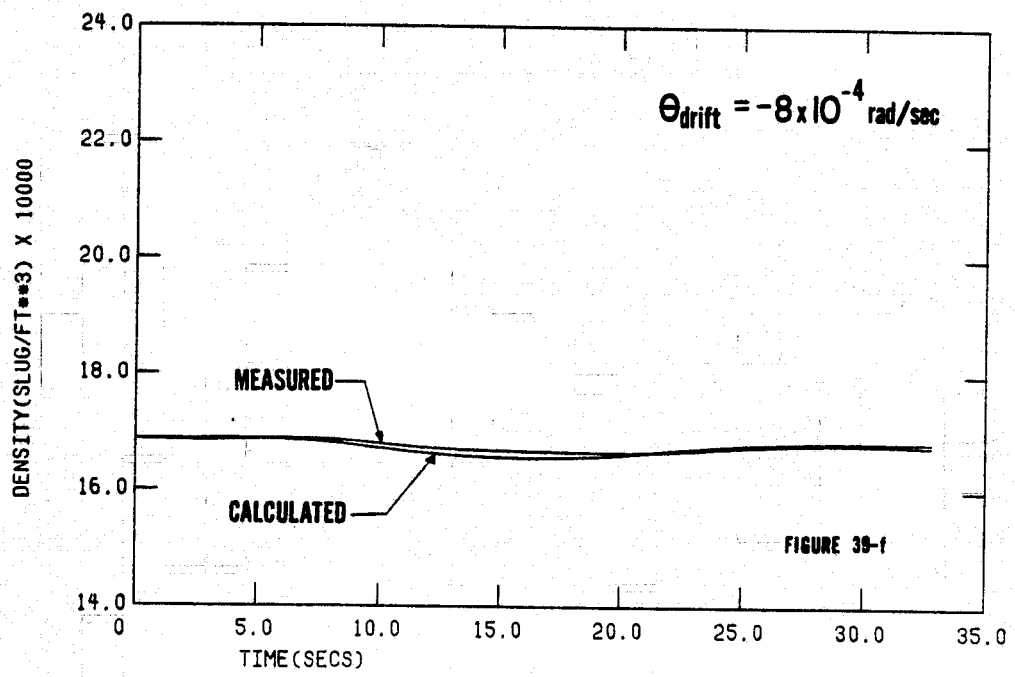
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



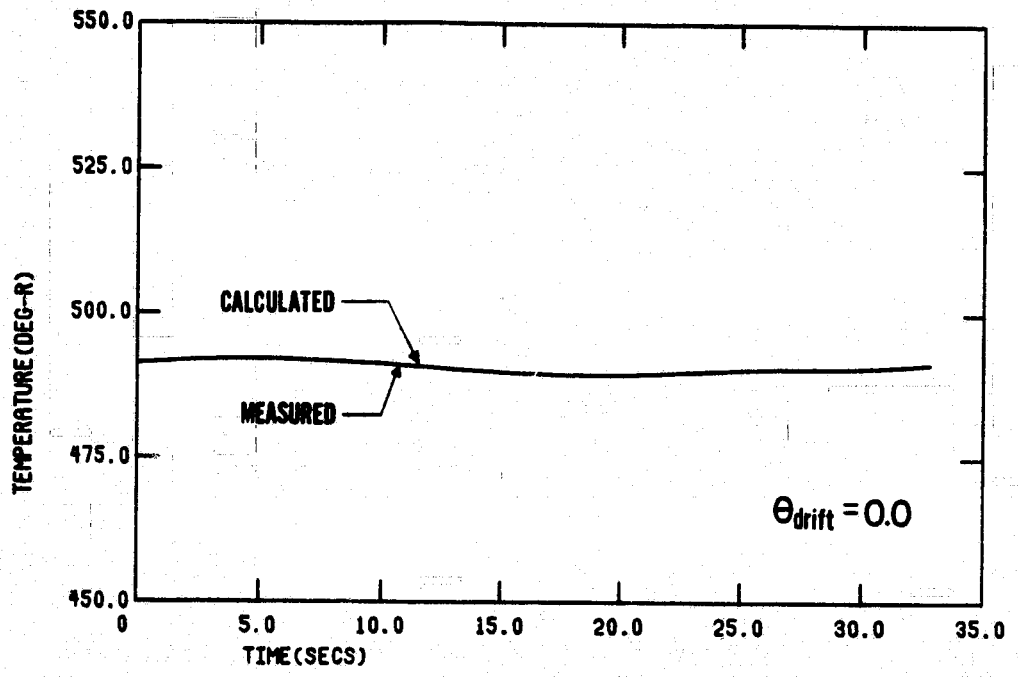


COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.





COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



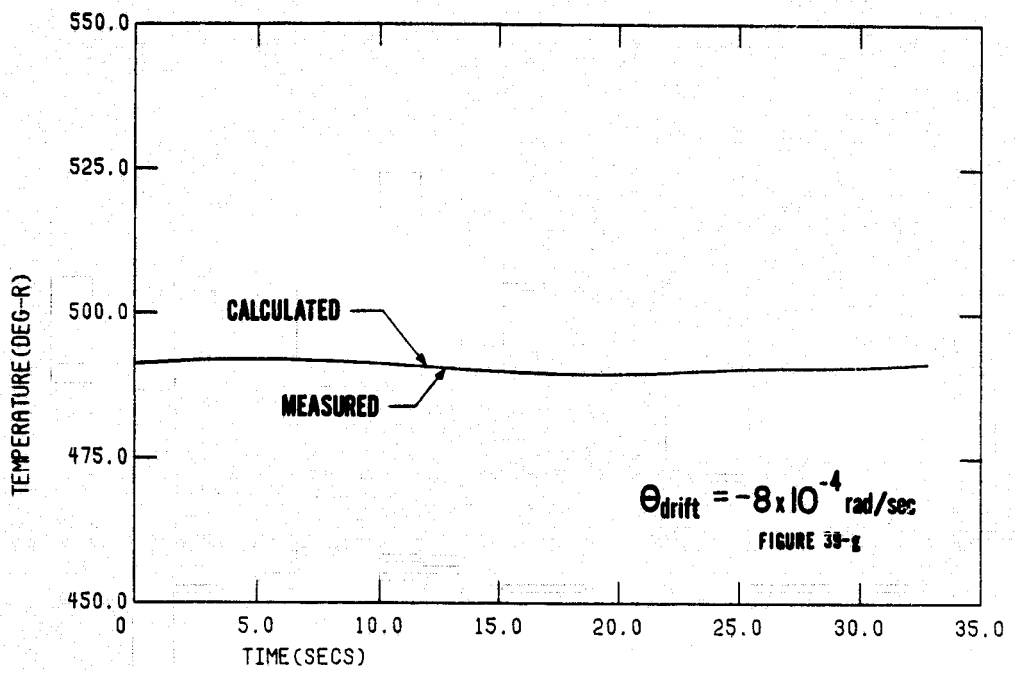
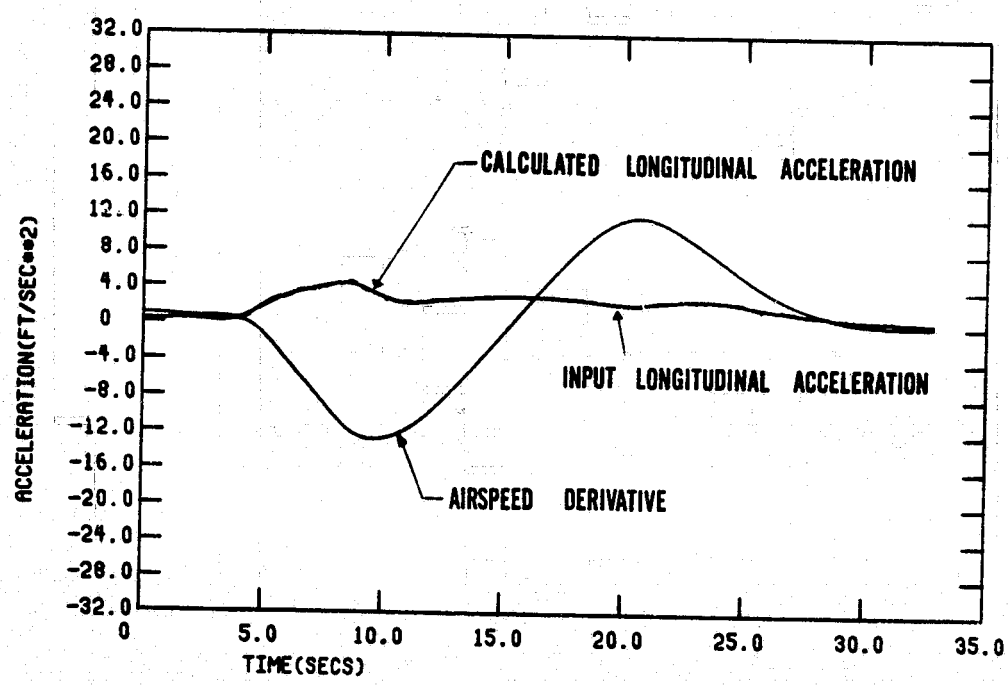
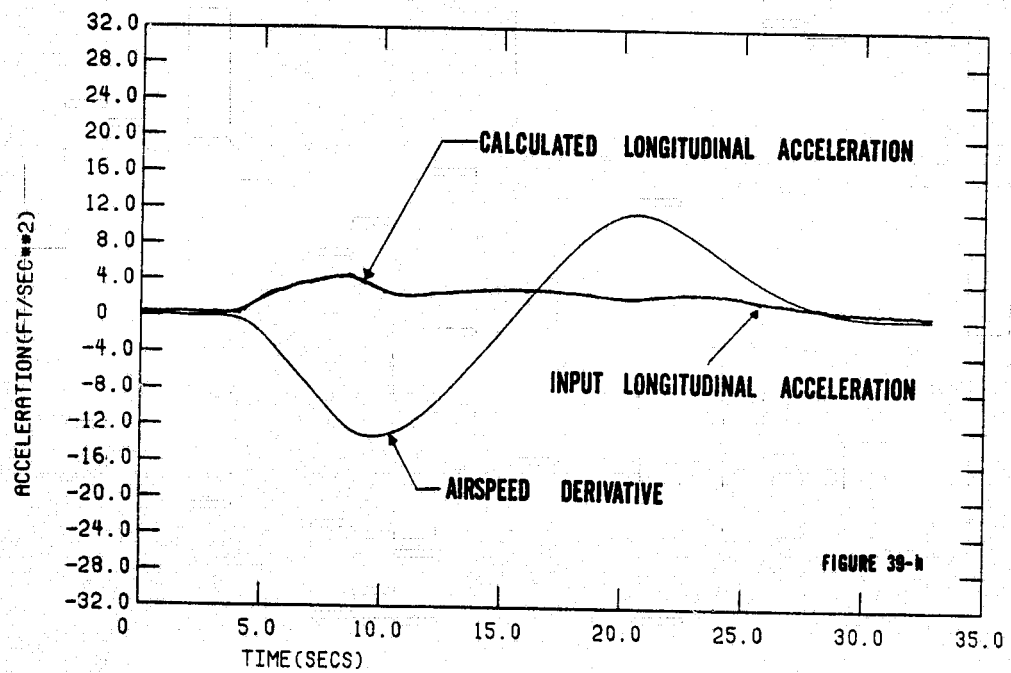


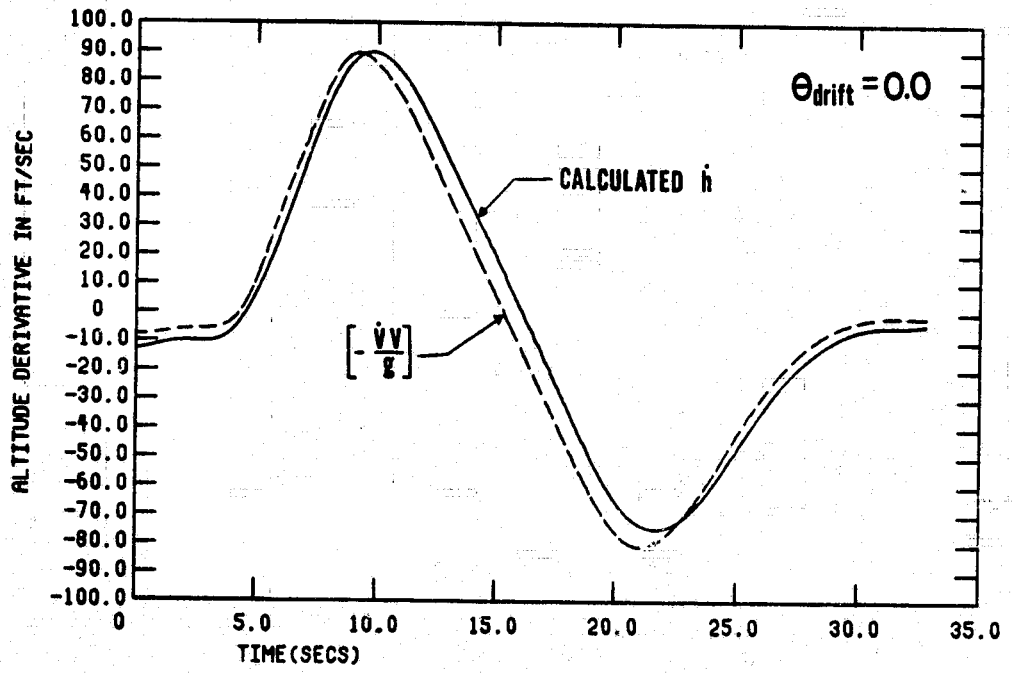
FIGURE 39-g

COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.





COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



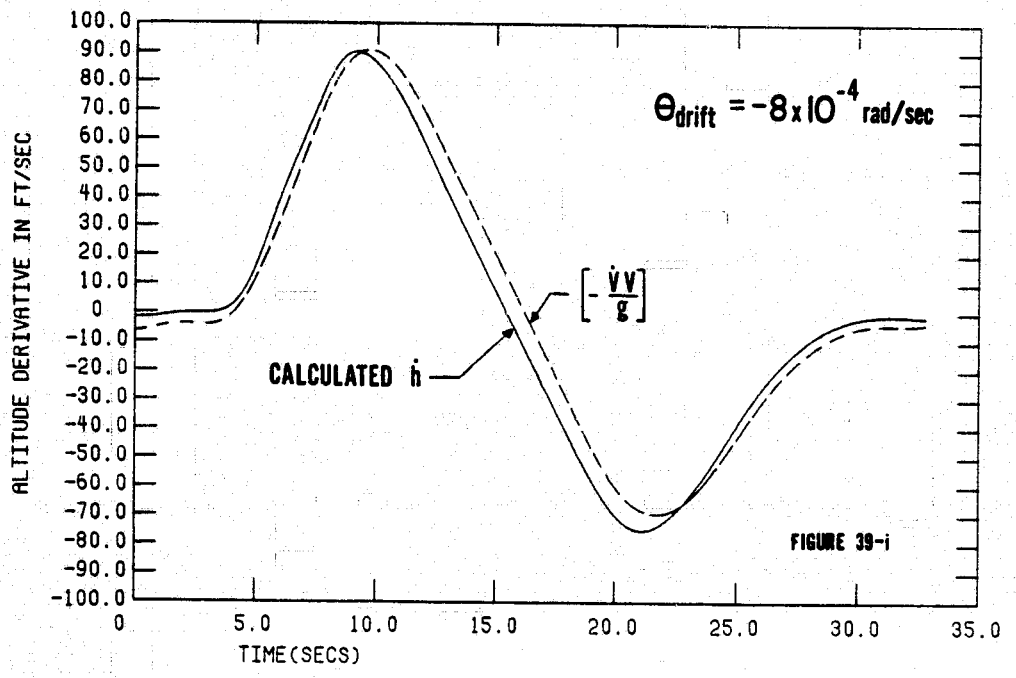
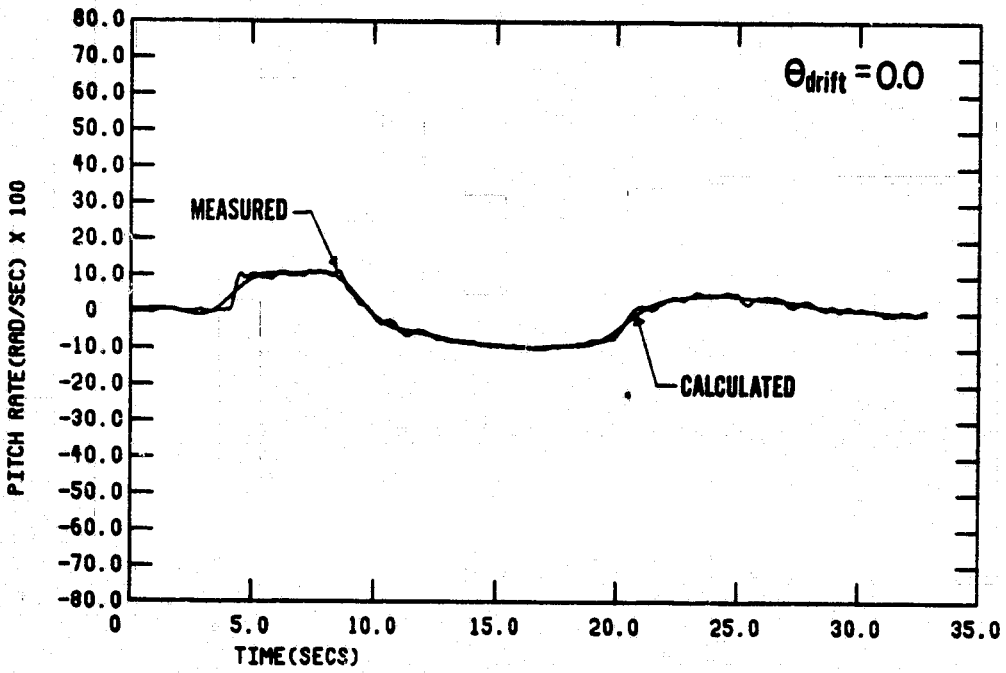
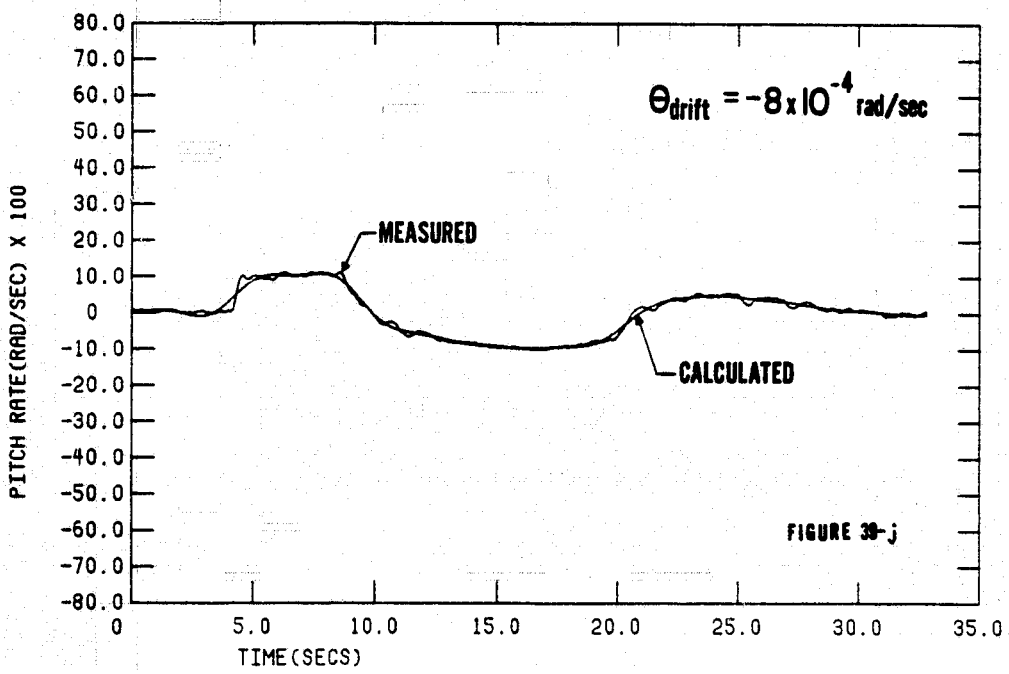


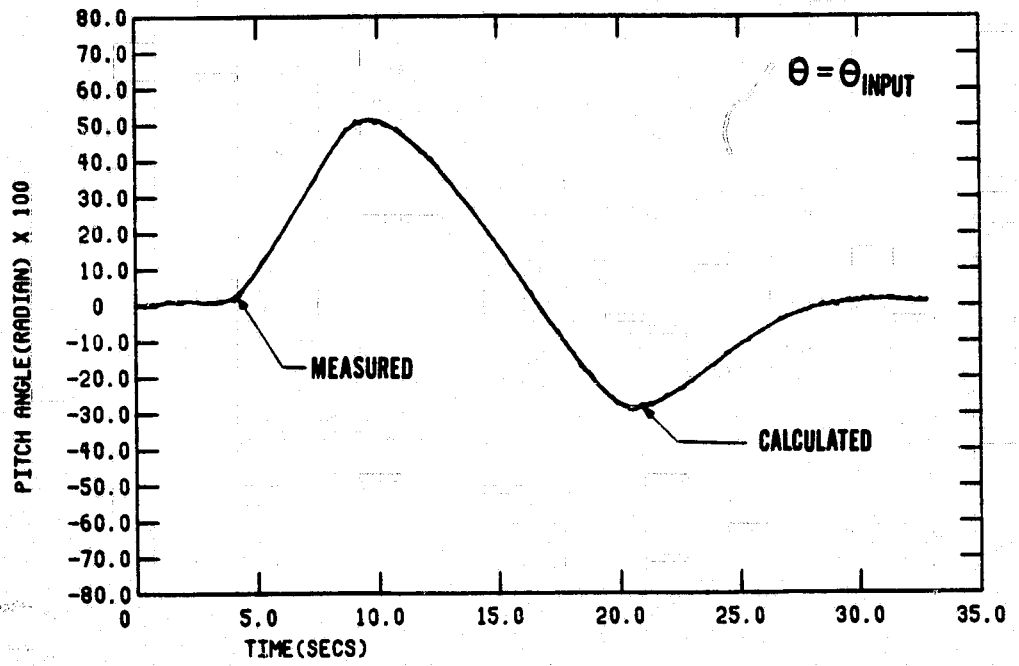
FIGURE 39-i

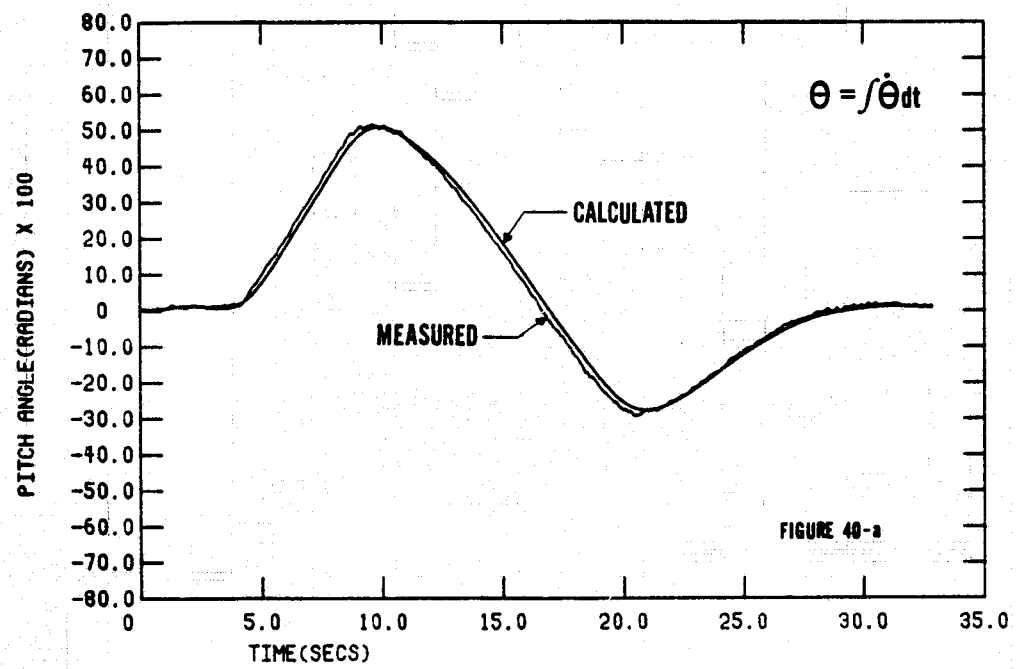
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



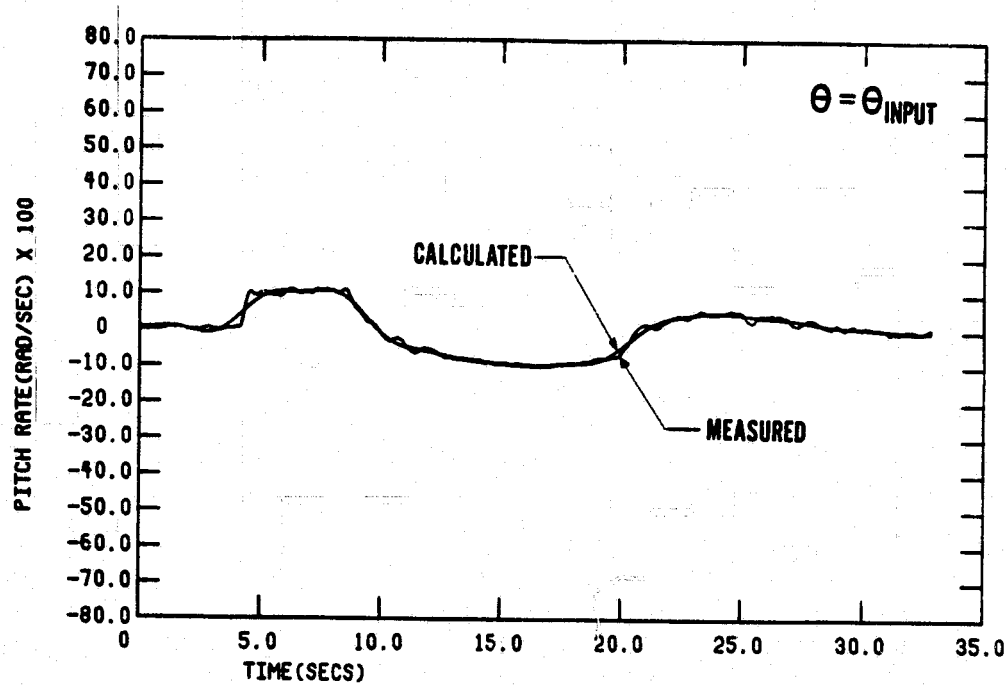


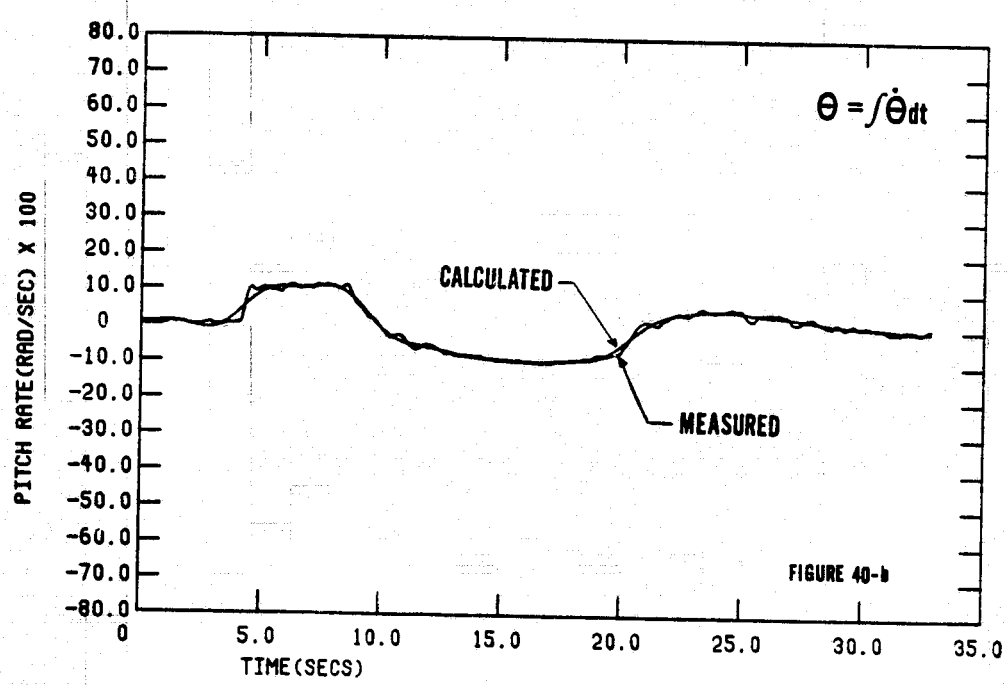
COMPARISON OF CALCULATED PULLUP-PUSHOVER TRAJECTORY WITH MEASURED VALUES. ASSUMED α POSITION ERROR CORRECTIONS: GAIN = 0.8667, BIAS = 0.0047.



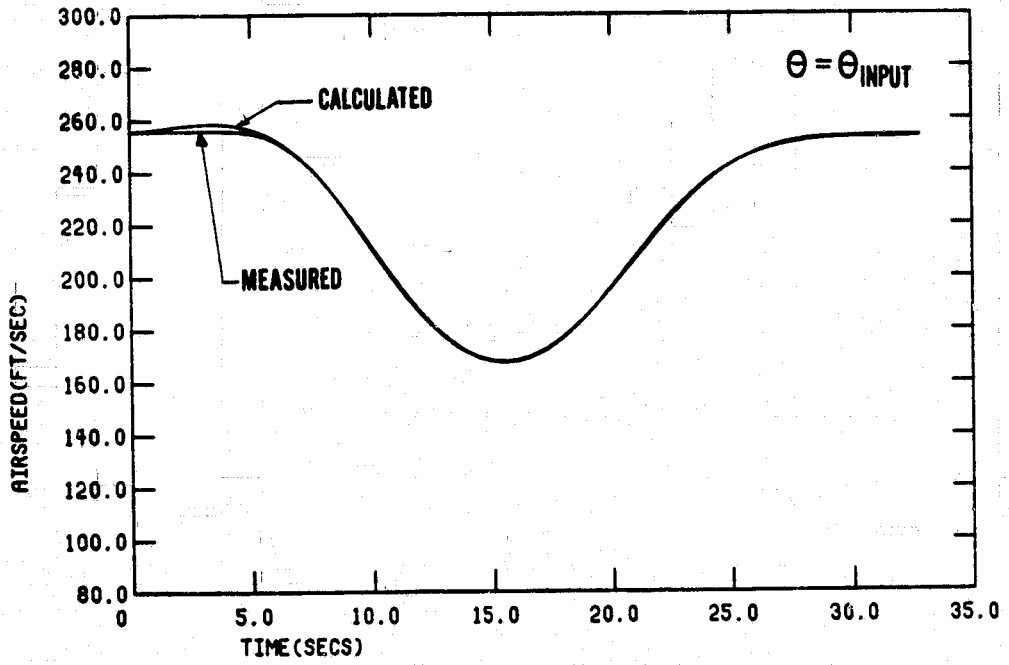


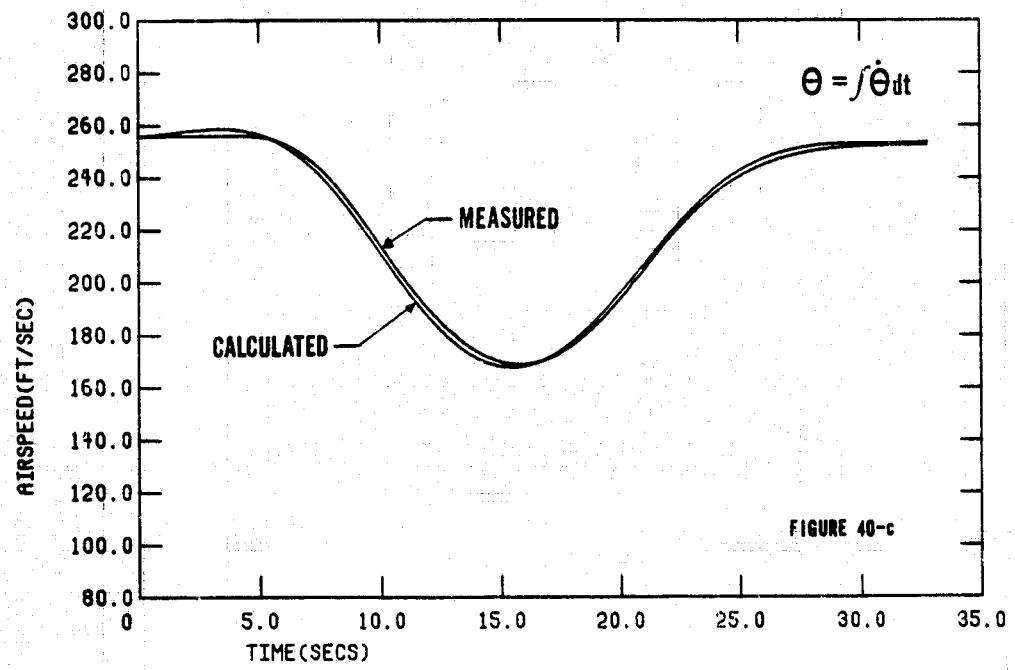
EFFECT OF USING $\int\dot{\theta}dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.



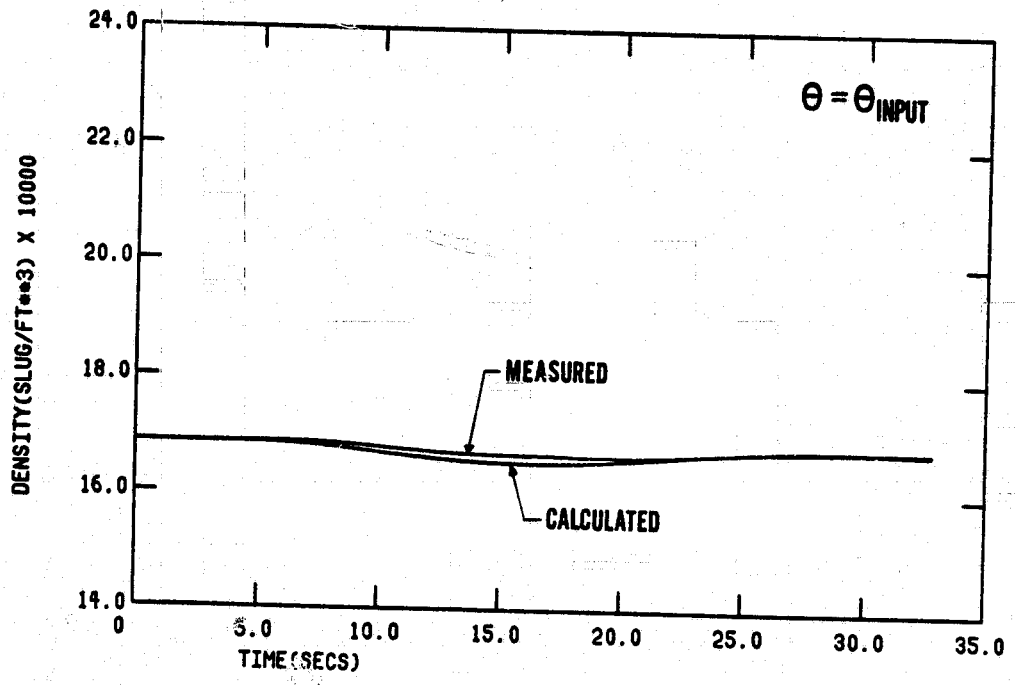


EFFECT OF USING $\int\dot{\theta}dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.





EFFECT OF USING $\int \dot{\theta} dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025 t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.



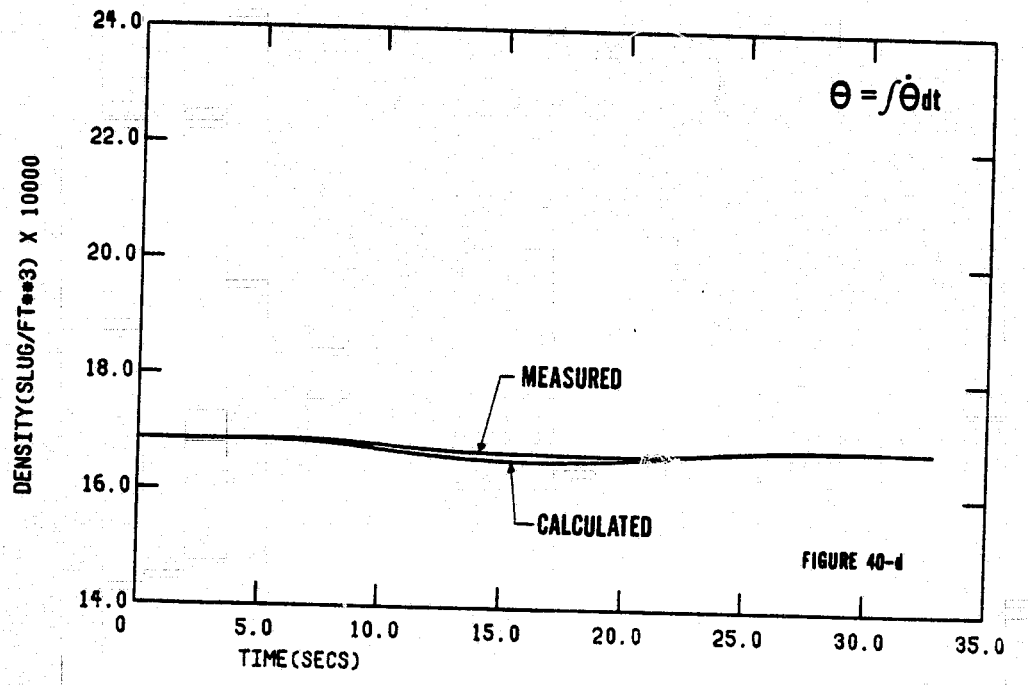
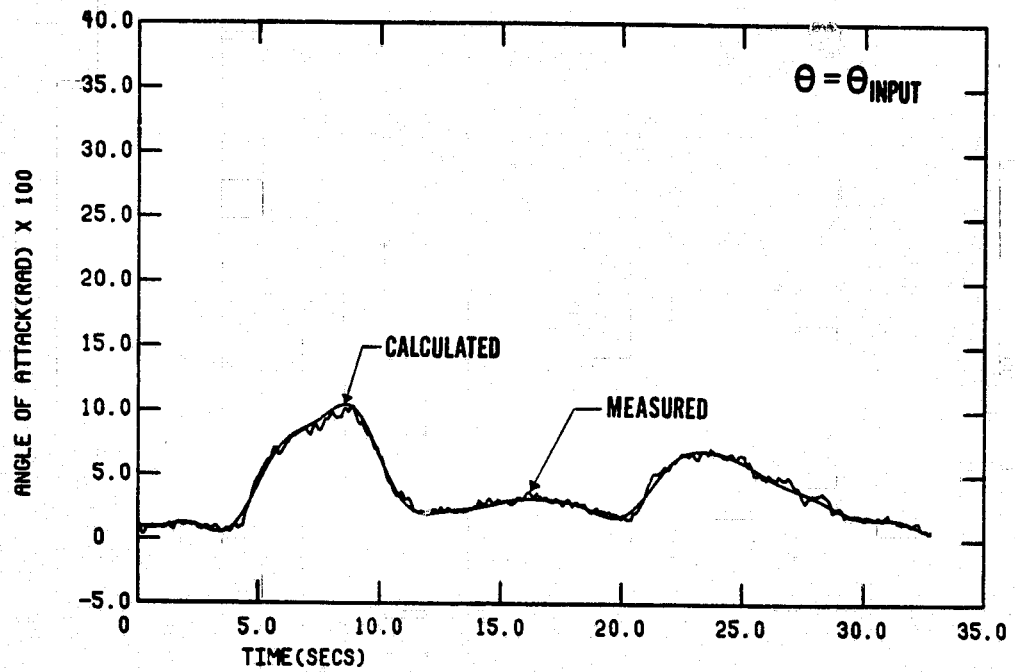
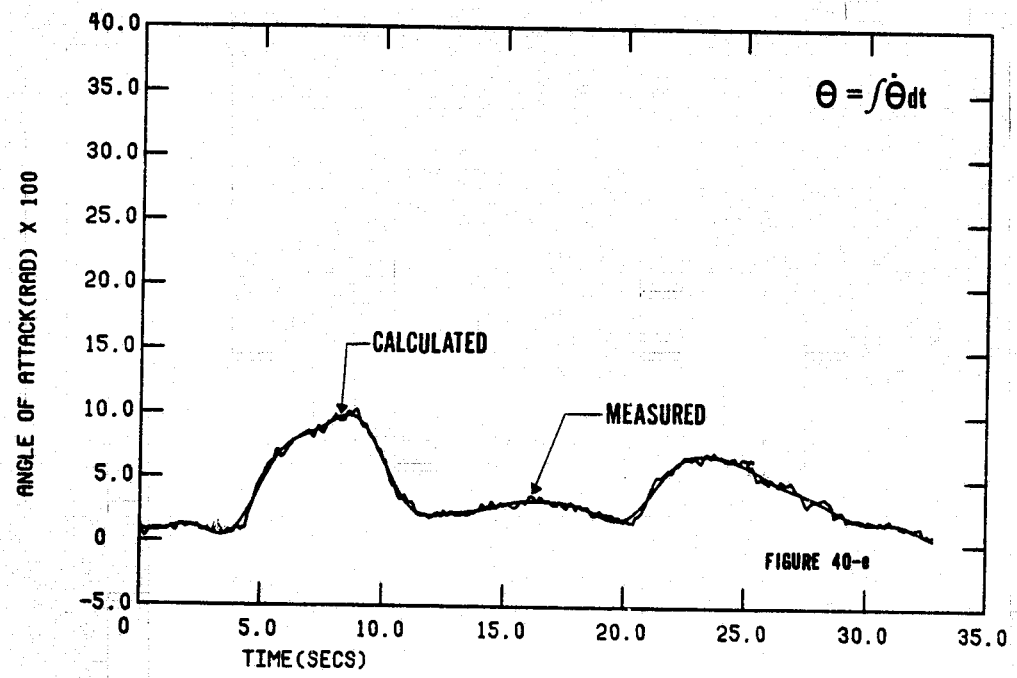


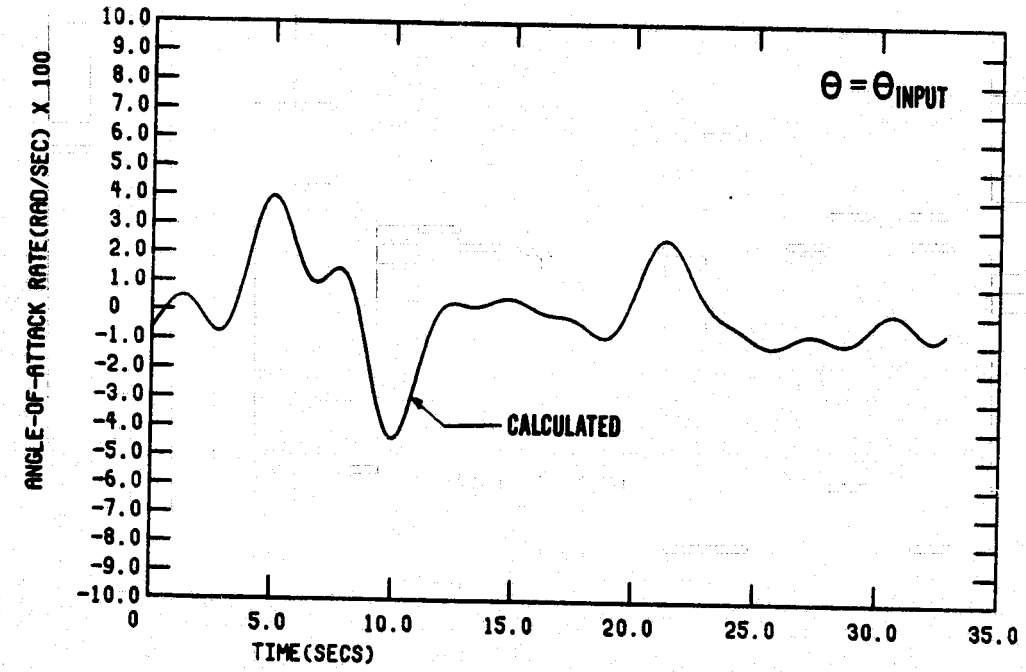
FIGURE 40-d

EFFECT OF USING $\int\dot{\theta}dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.





EFFECT OF USING $\int\dot{\theta}dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.



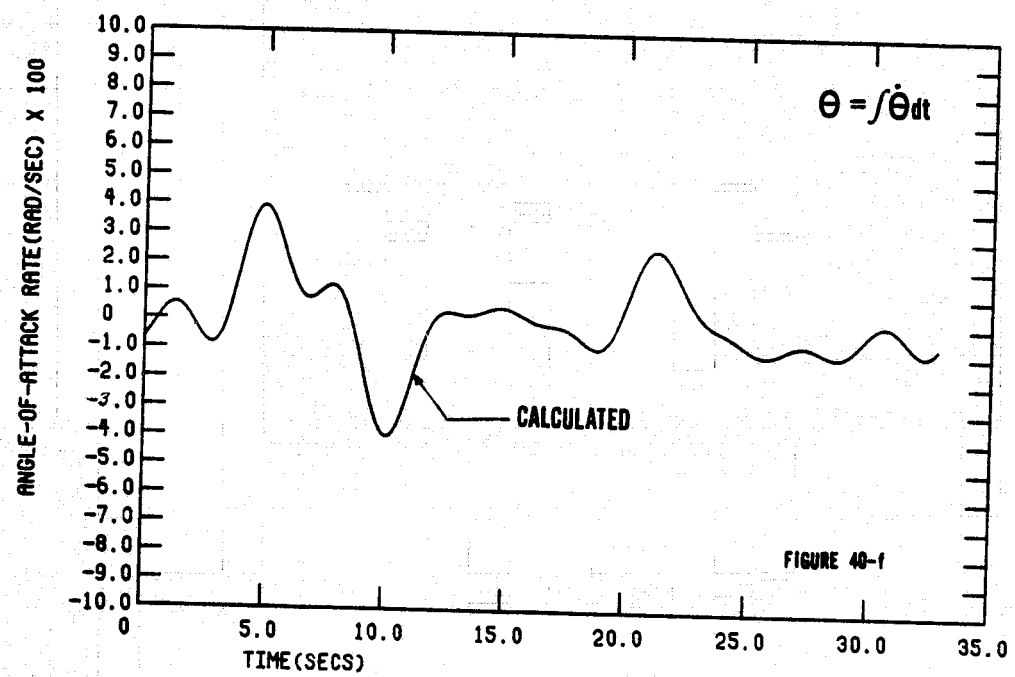
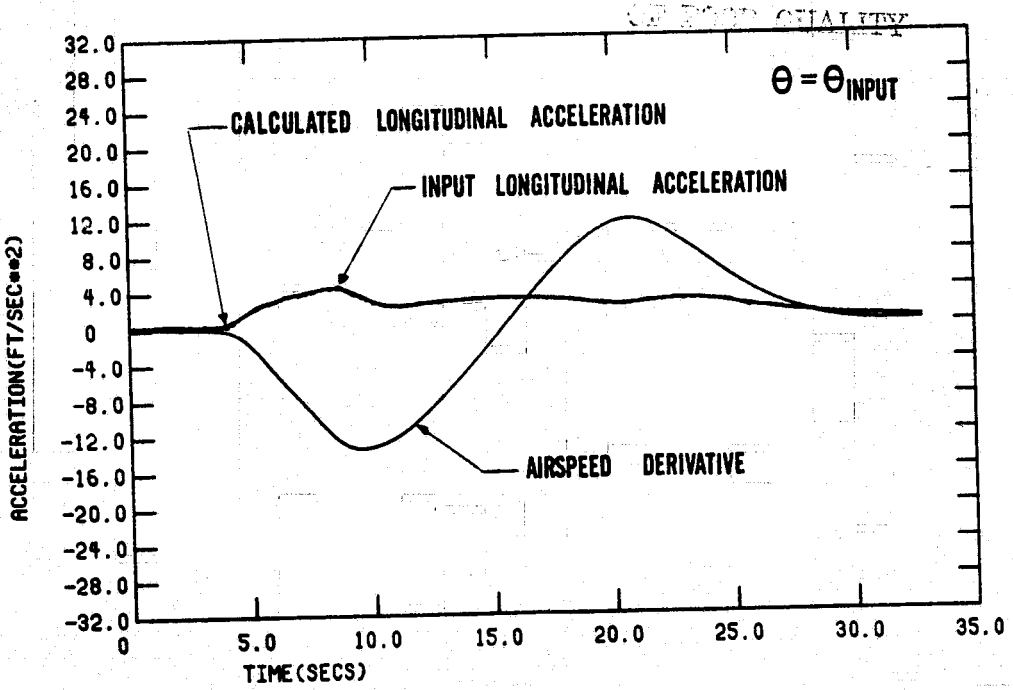


FIGURE 40-f

EFFECT OF USING $\int \dot{\theta} dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\, t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.

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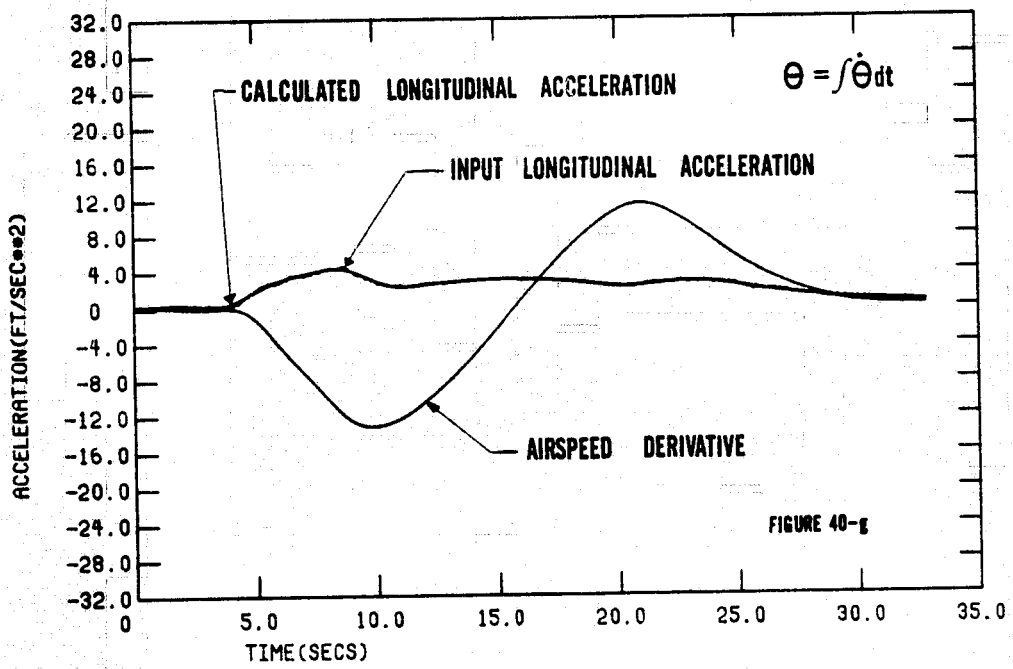
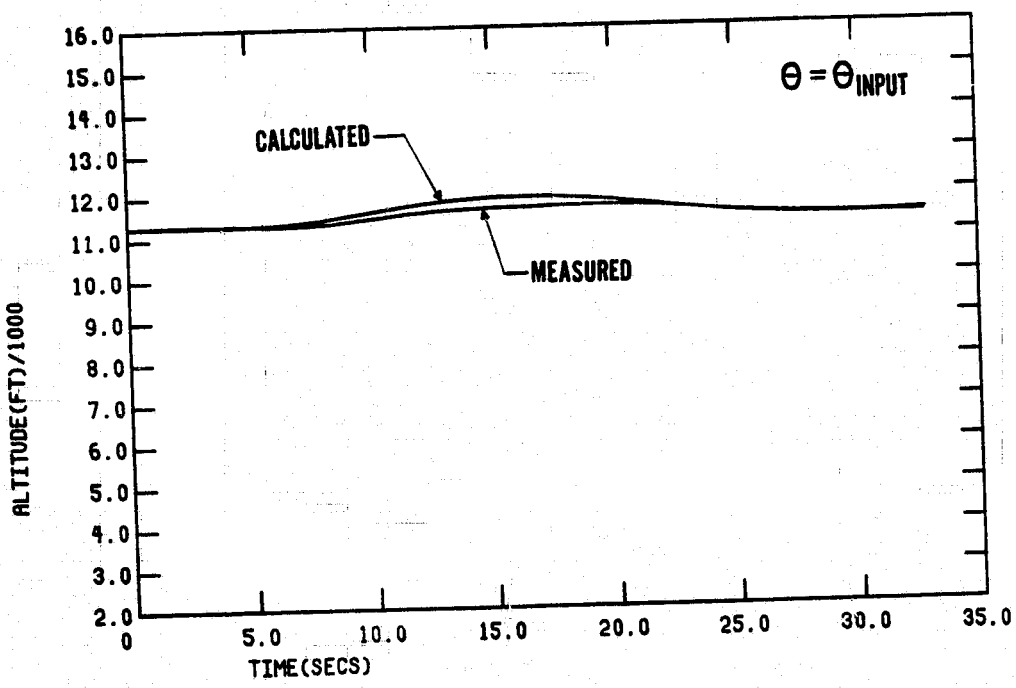
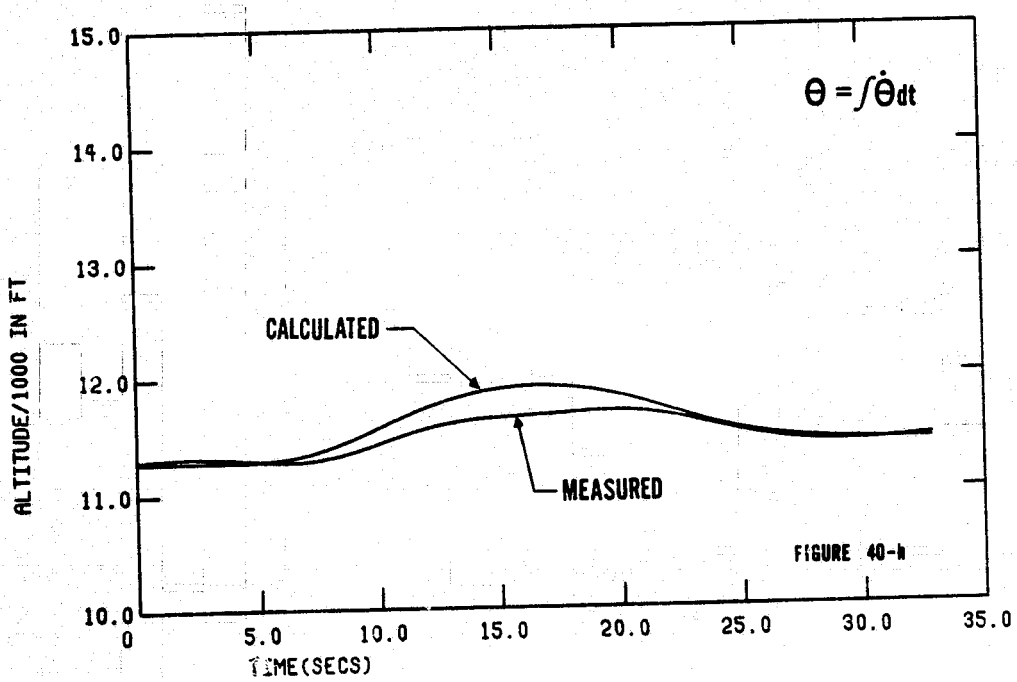


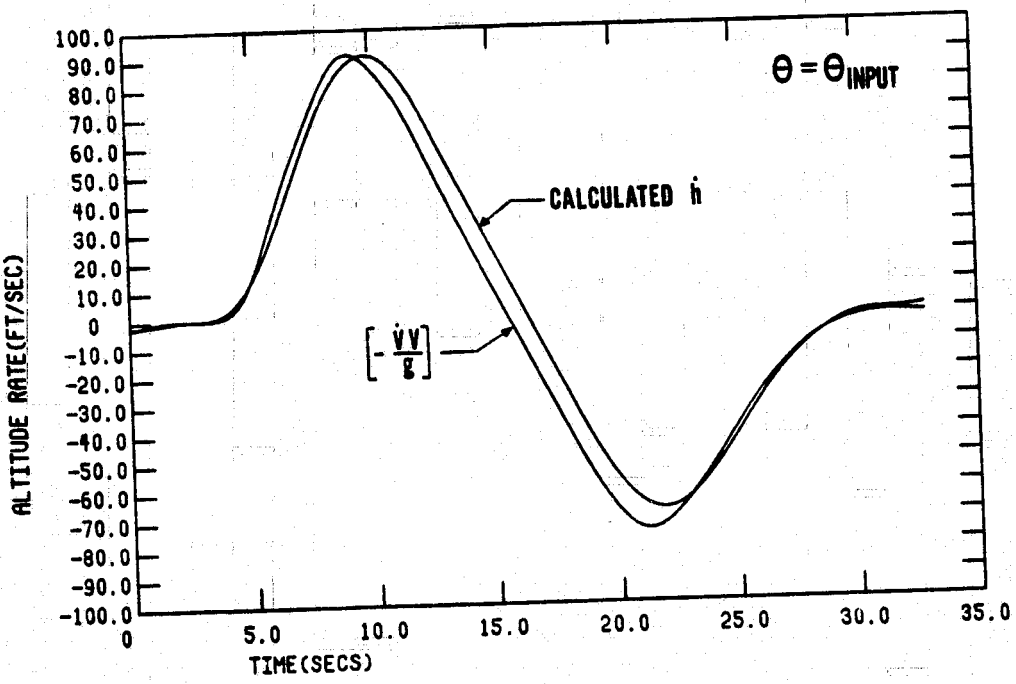
FIGURE 40-g

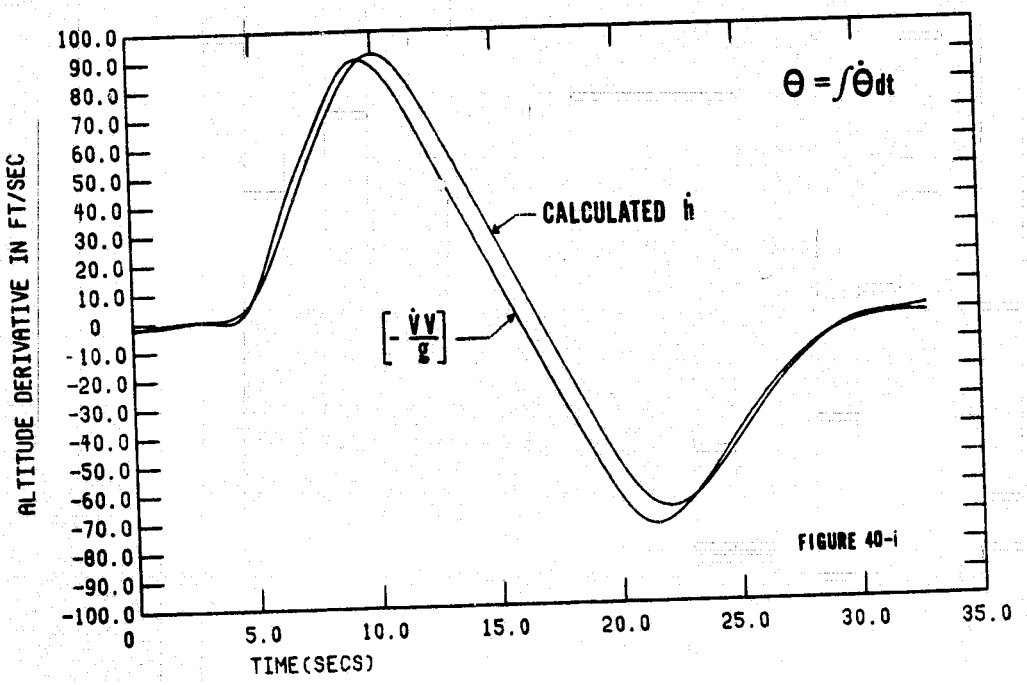
EFFECT OF USING $\int\dot{\theta}dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.



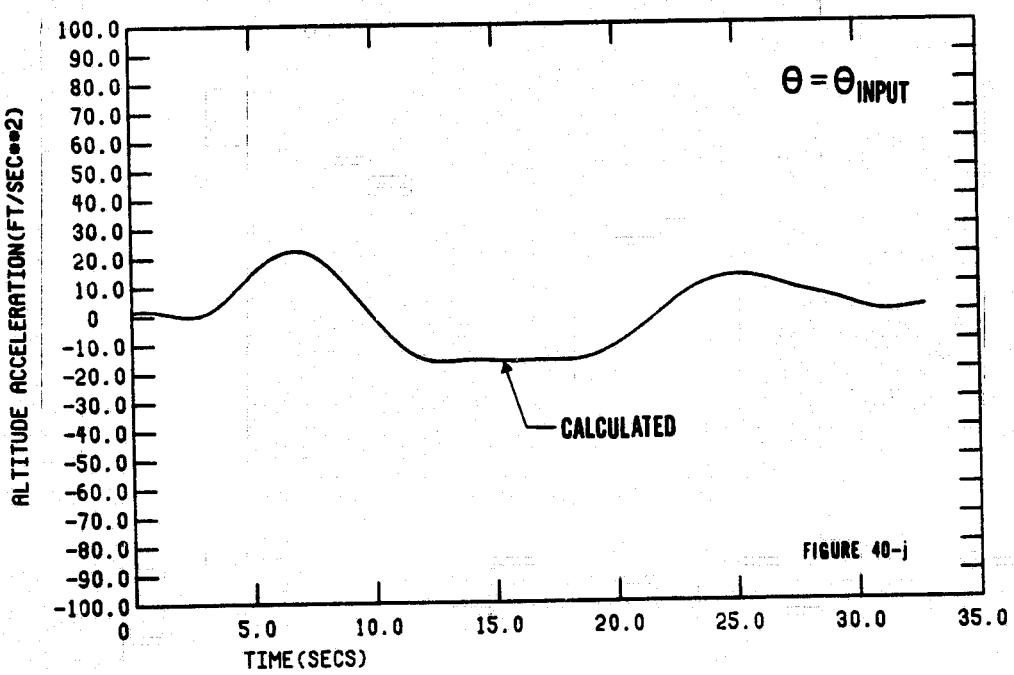


EFFECT OF USING $\int \dot{\theta} dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\,t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.

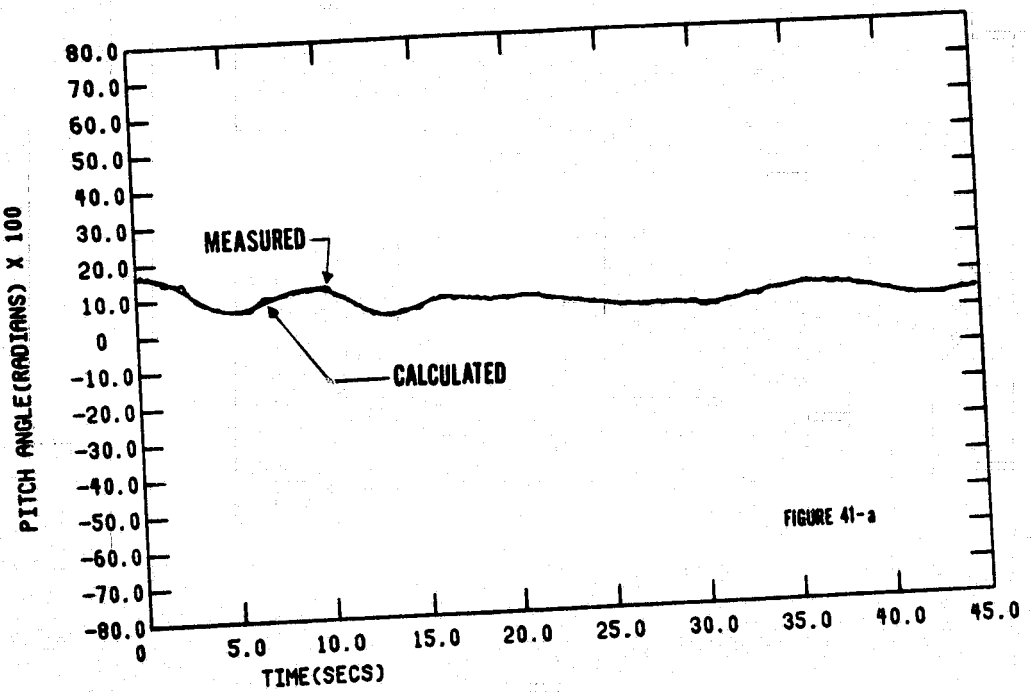


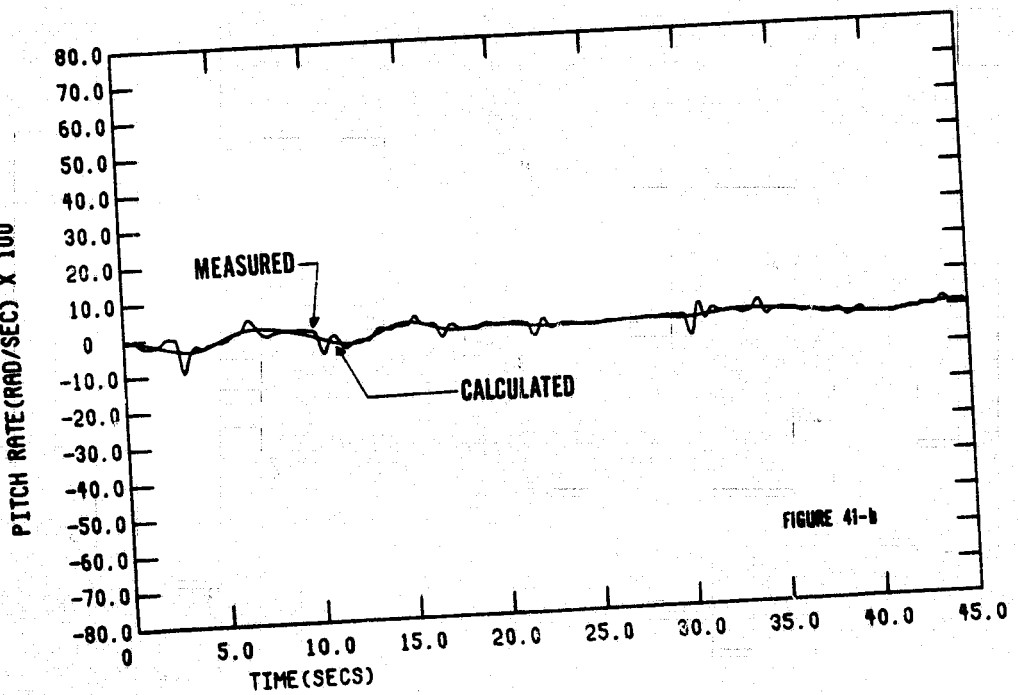


EFFECT OF USING $\int \dot{\theta} dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\, t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.

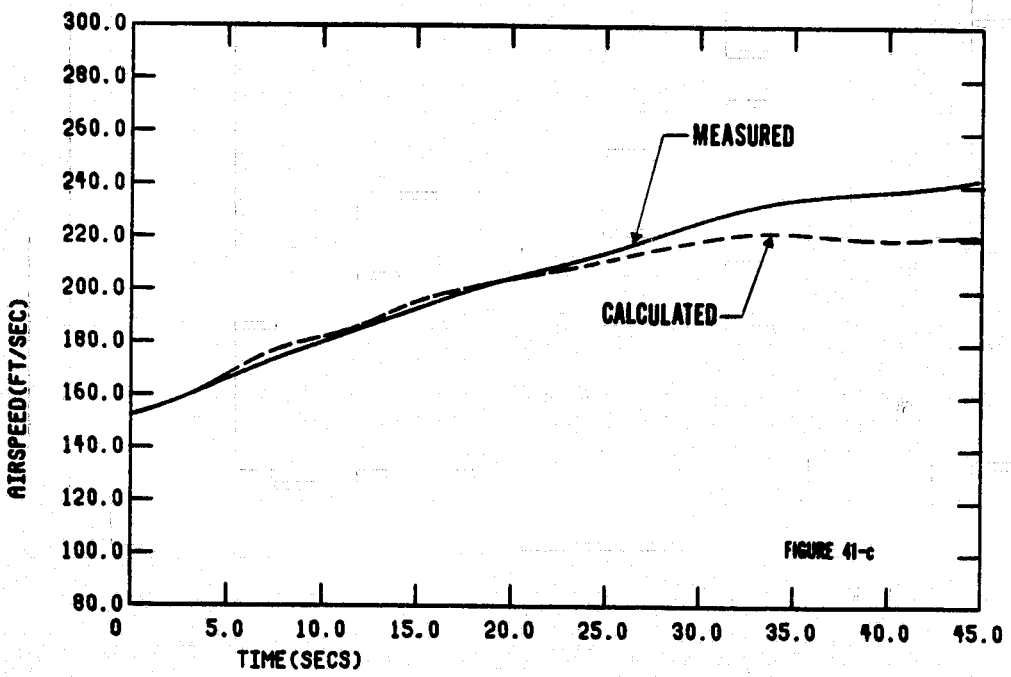


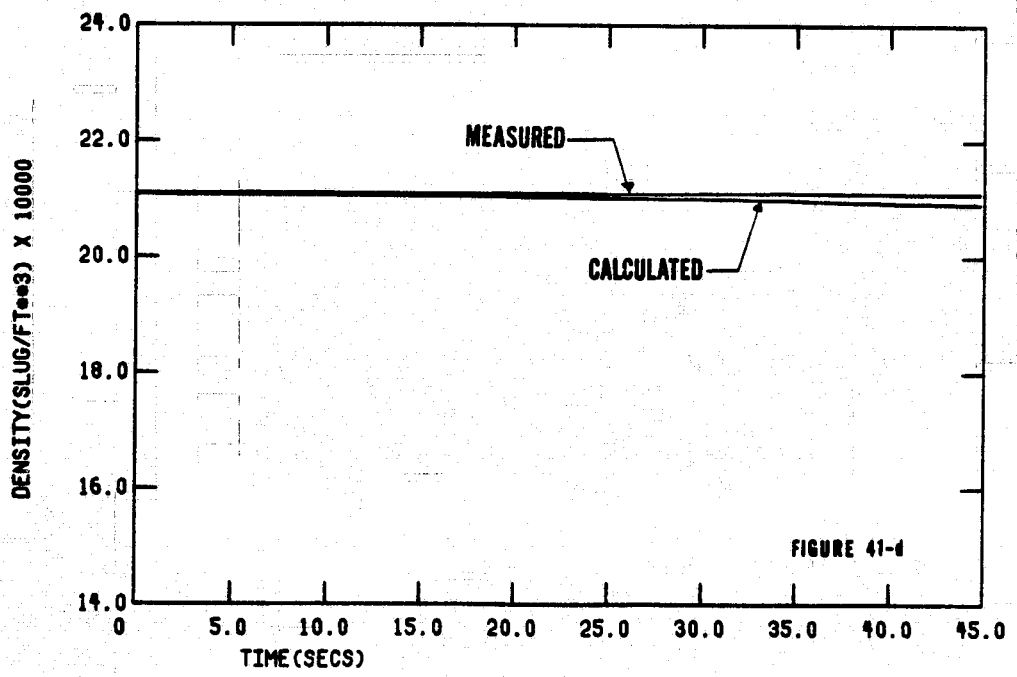
EFFECT OF USING $\int \dot{\theta} dt$ FOR θ IN CALCULATED SOLUTIONS. ASSUMED $\theta_{drift} = -0.025\, t/T$. ASSUMED α POSITION ERROR CORRECTIONS GAIN 1.1538, BIAS -0.02 RADIANS.



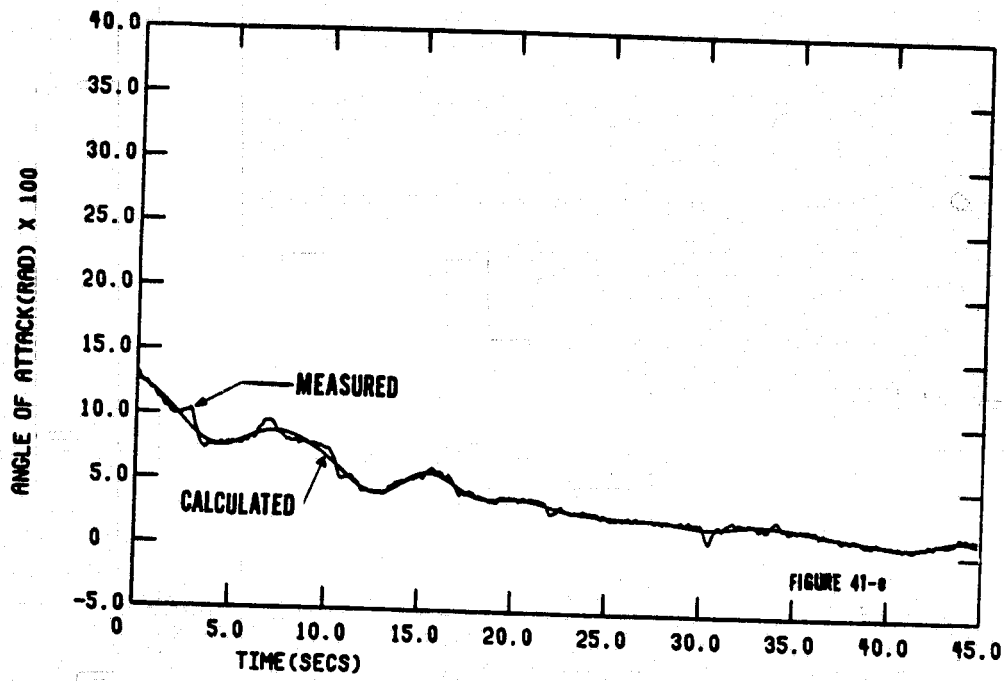


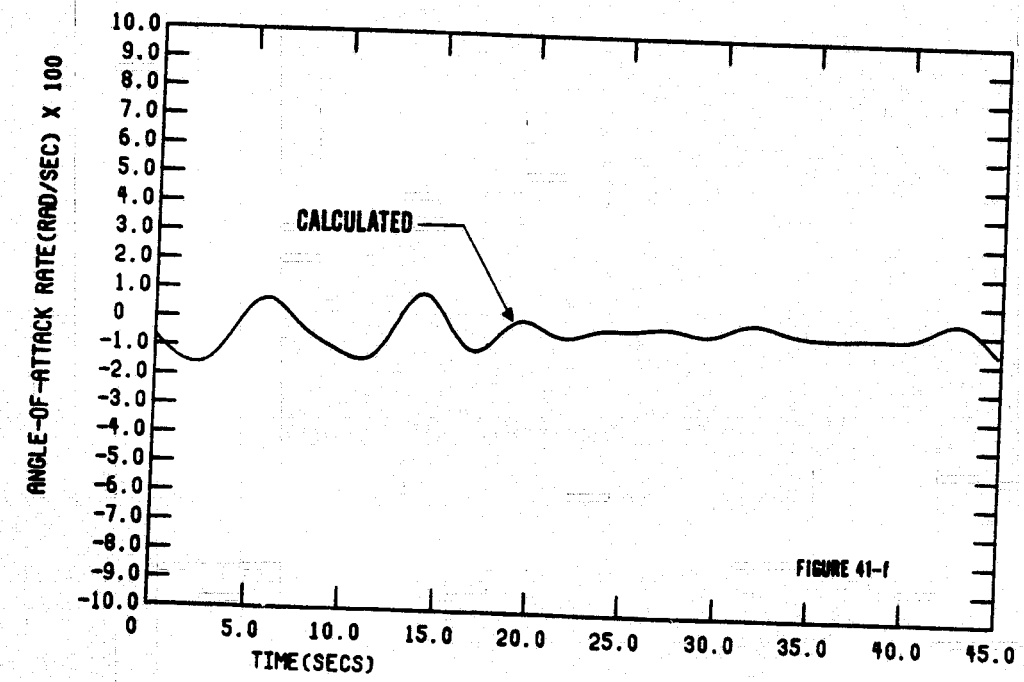
LEVEL FLIGHT ACCELERATION: COMPARISON OF MEASURED AND COMPUTED VALUES. NO θ DRIFT ASSUMED. α POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.0047.



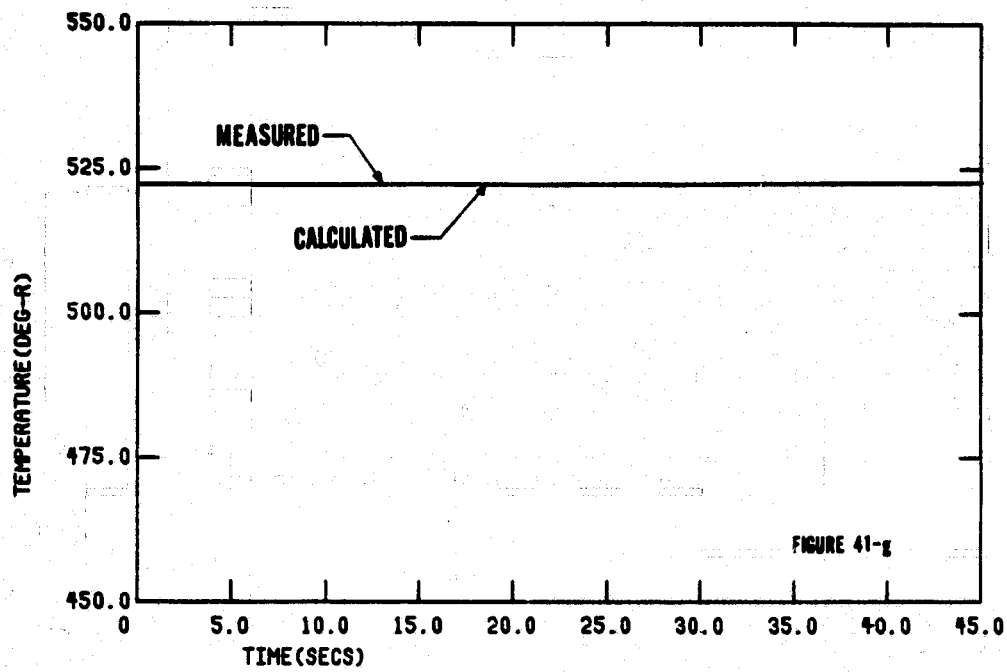


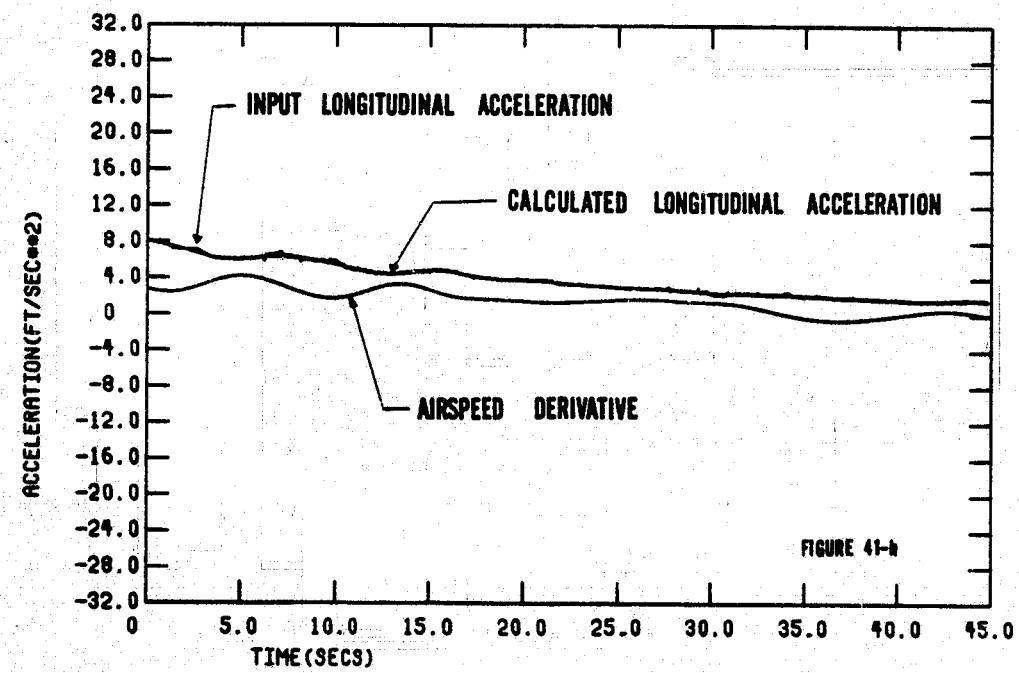
LEVEL FLIGHT ACCELERATION: COMPARISON OF MEASURED AND COMPUTED VALUES. NO θ DRIFT ASSUMED. α POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.0047.



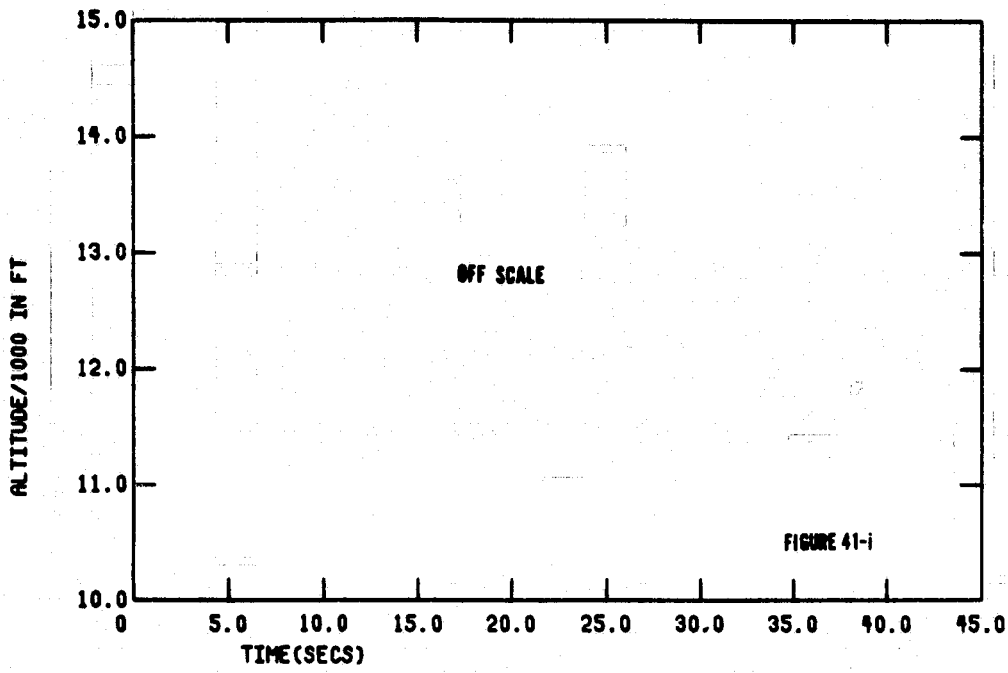


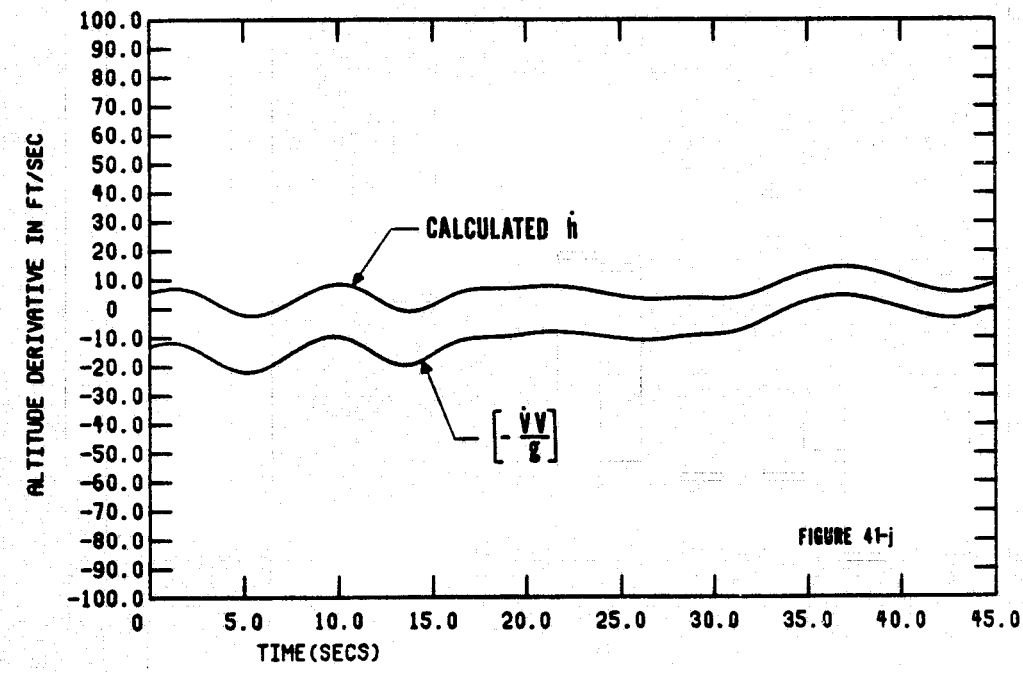
LEVEL FLIGHT ACCELERATION: COMPARISON OF MEASURED AND COMPUTED VALUES. NO θ DRIFT ASSUMED. α POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.0047.





LEVEL FLIGHT ACCELERATION: COMPARISON OF MEASURED AND COMPUTED VALUES. NO θ DRIFT ASSUMED. α POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.0047.





LEVEL FLIGHT ACCELERATION: COMPARISON OF MEASURED AND COMPUTED VALUES. NO θ DRIFT ASSUMED. α POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.0047.

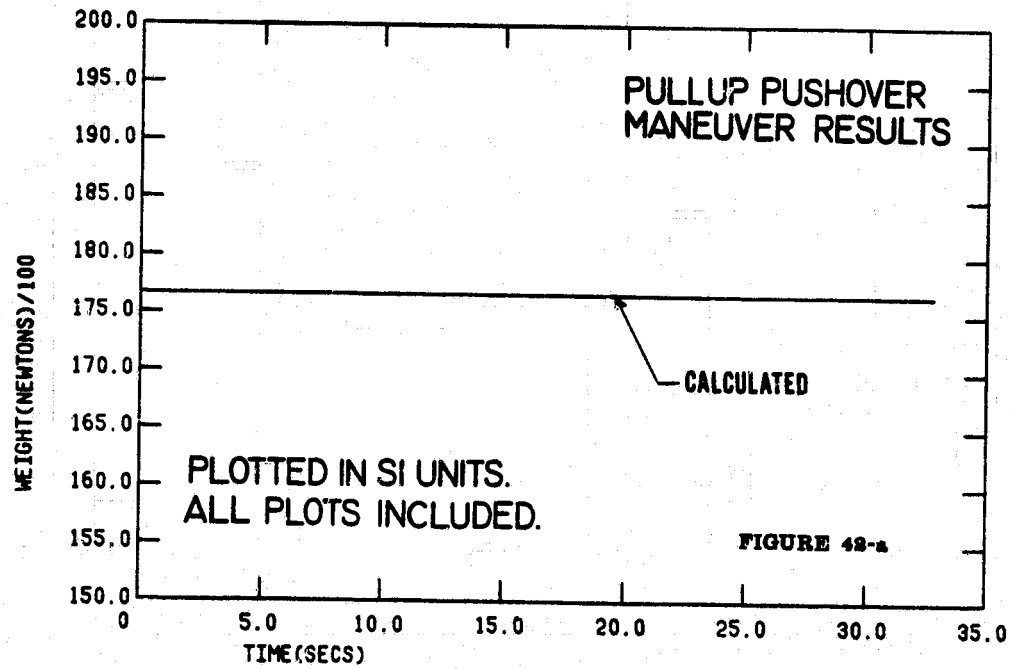


FIGURE 42-a

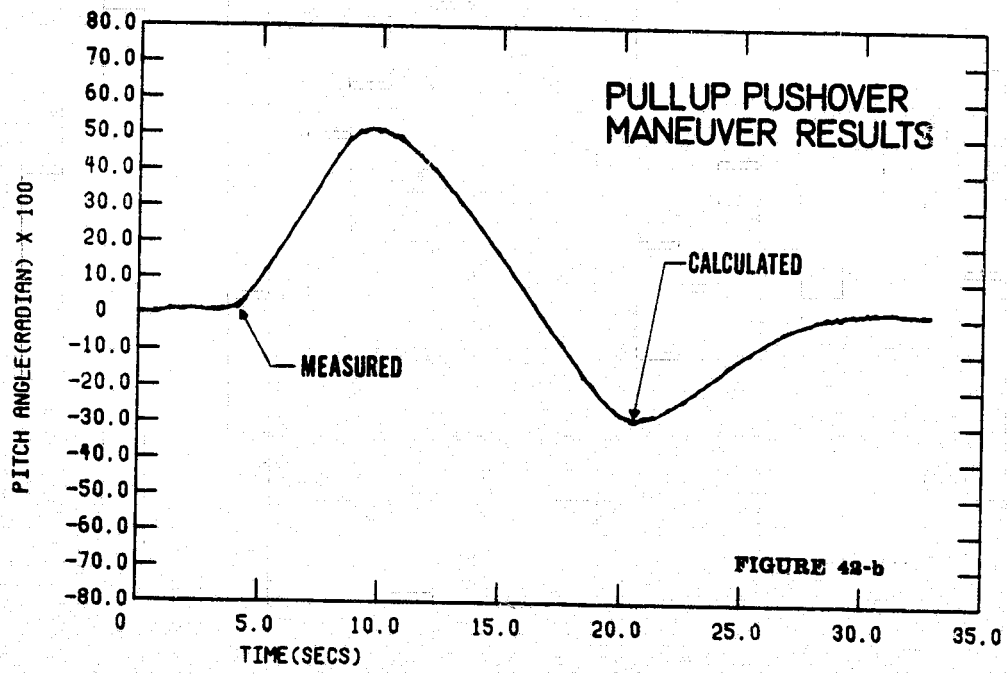


FIGURE 42-b

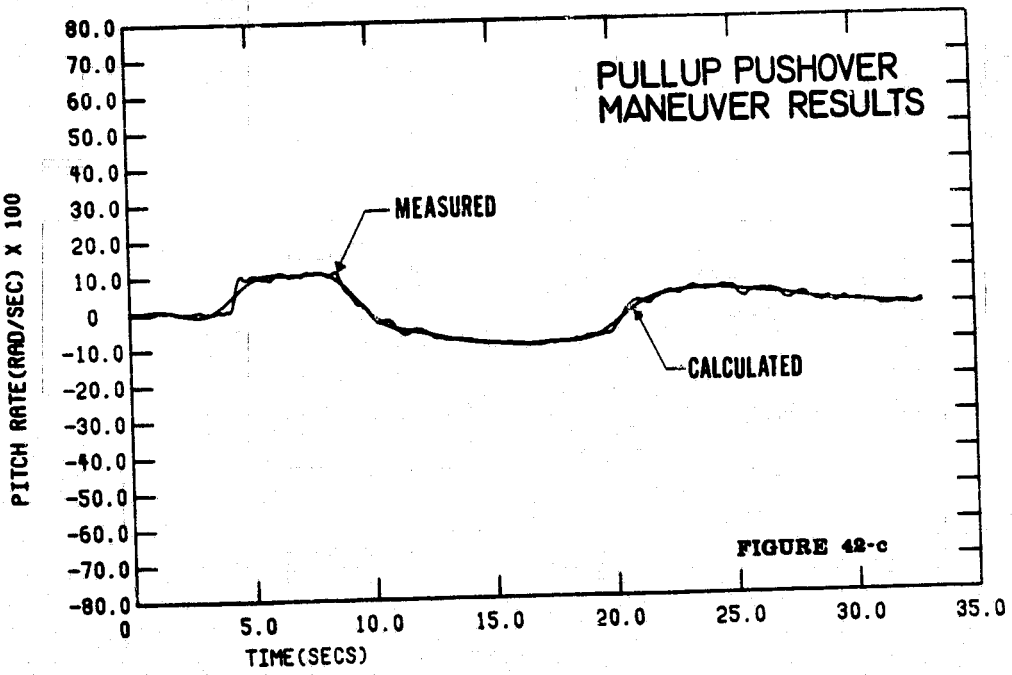


FIGURE 42-c

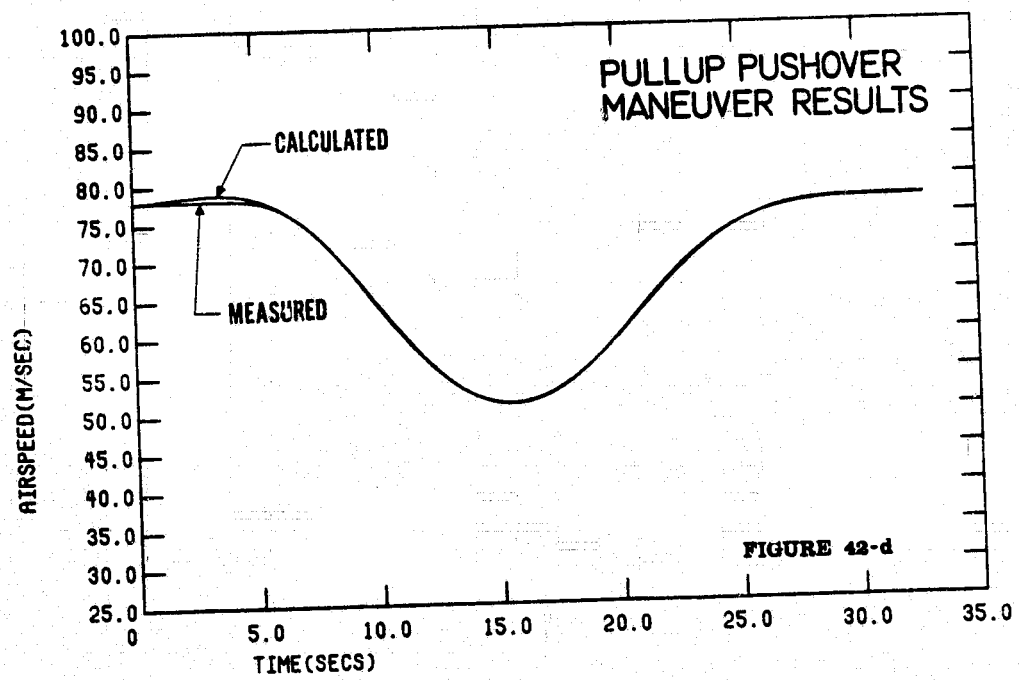


FIGURE 42-d

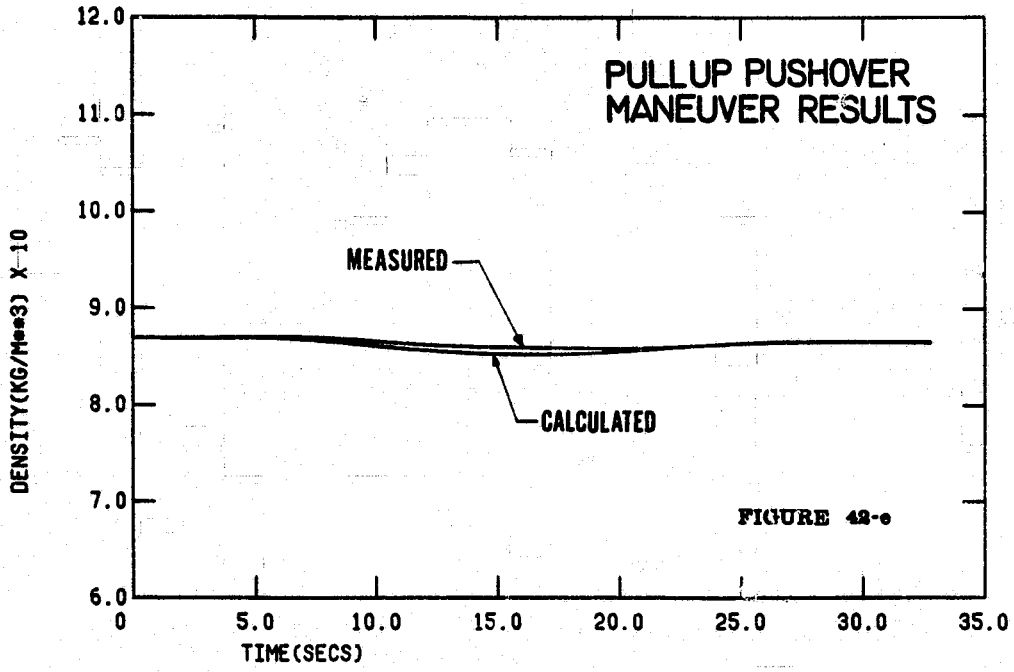


FIGURE 42-e

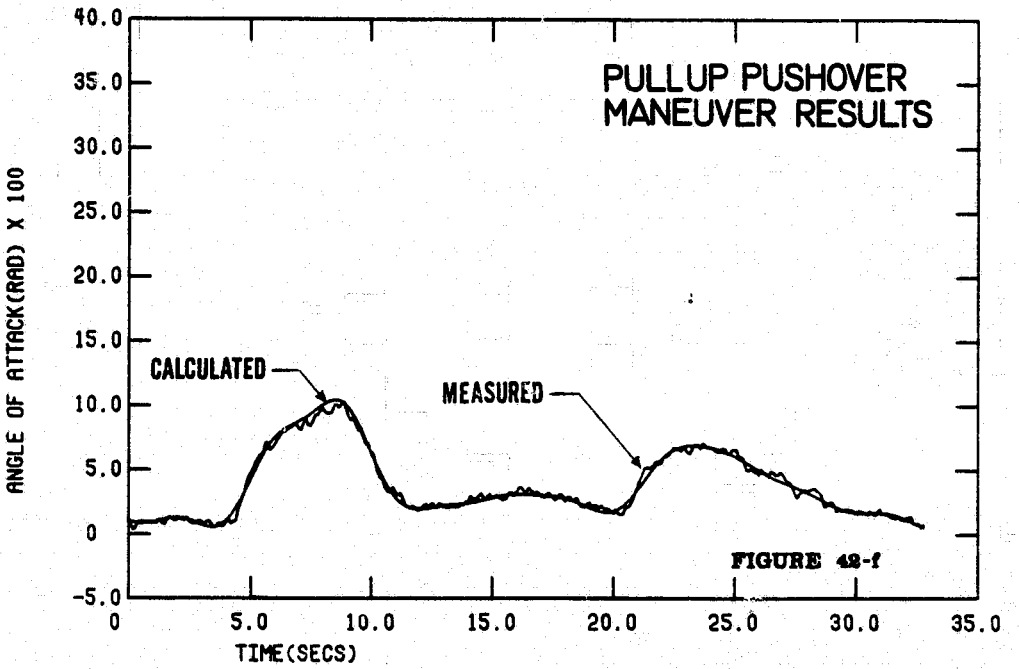


FIGURE 42-f

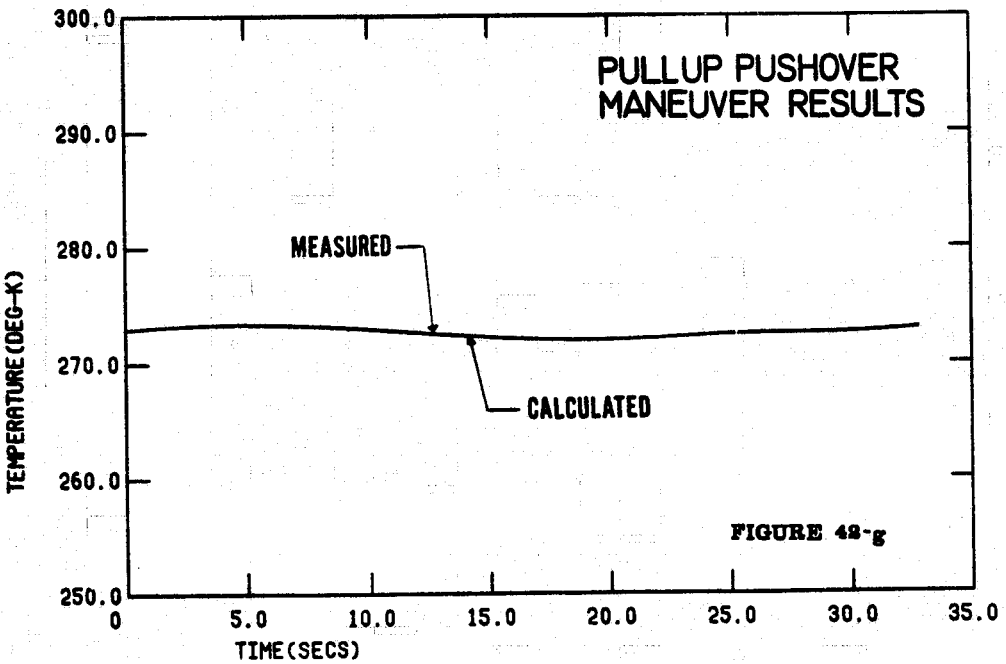


FIGURE 42-g

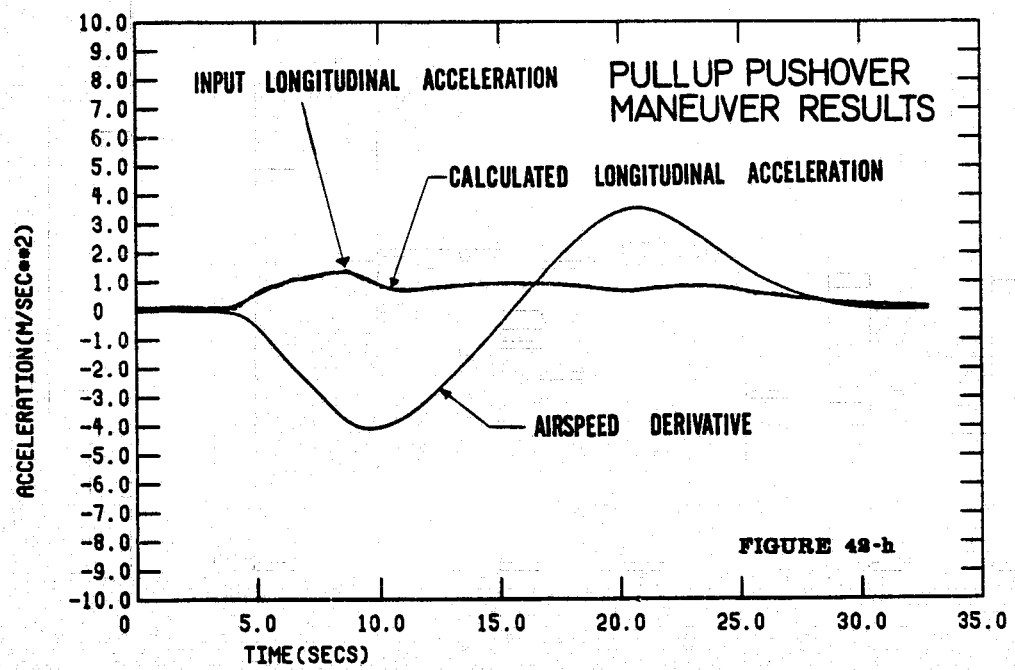


FIGURE 42-h

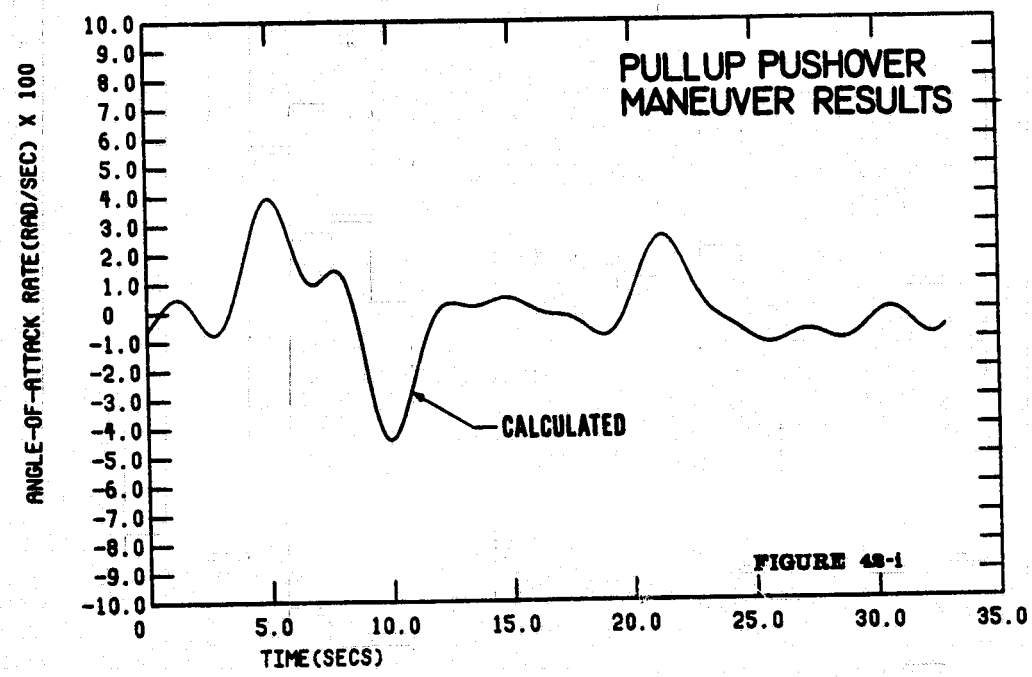


FIGURE 48-i

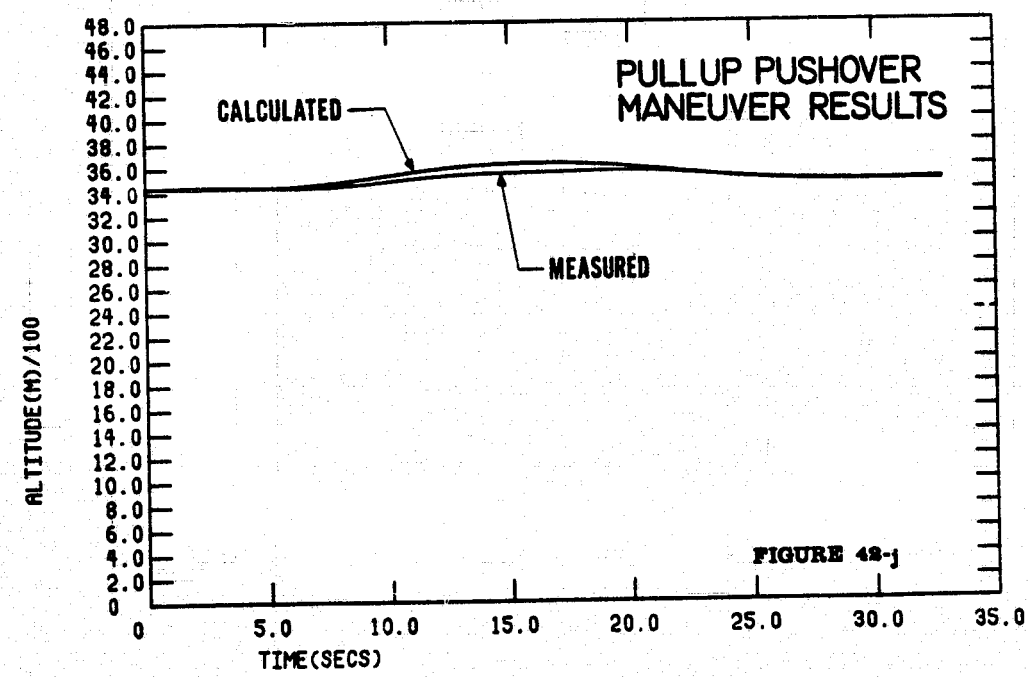


FIGURE 48-j

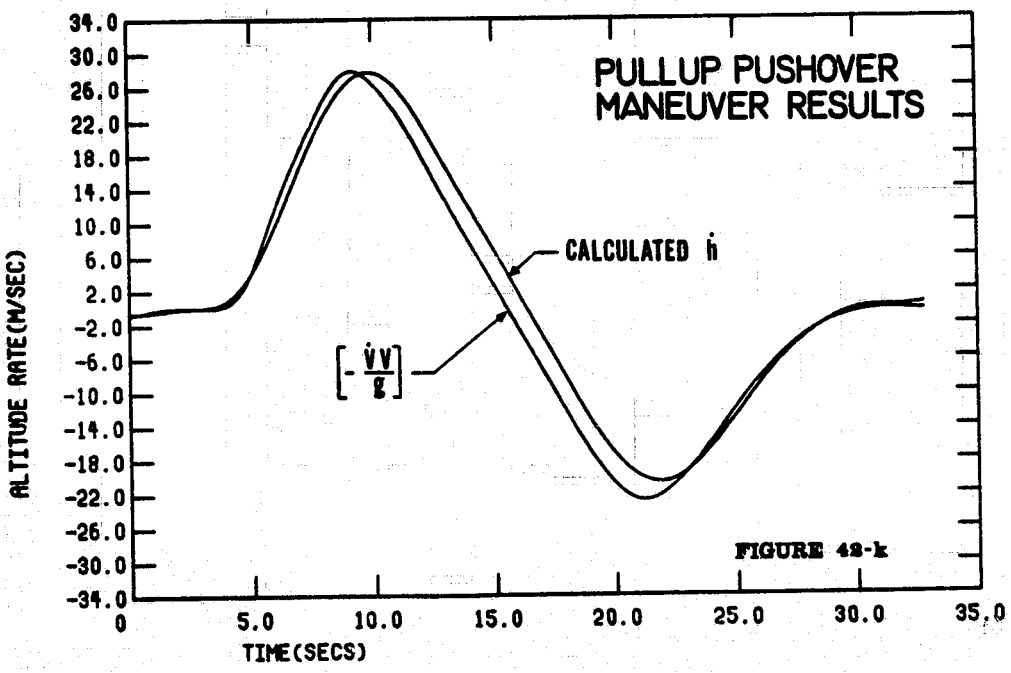


FIGURE 42-k

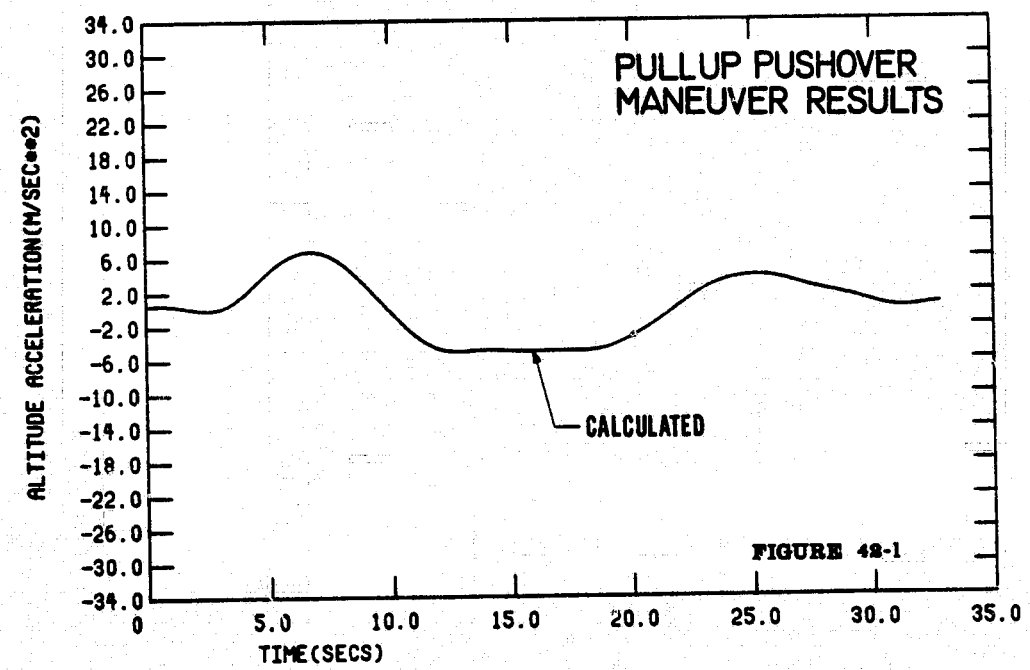


FIGURE 42-l

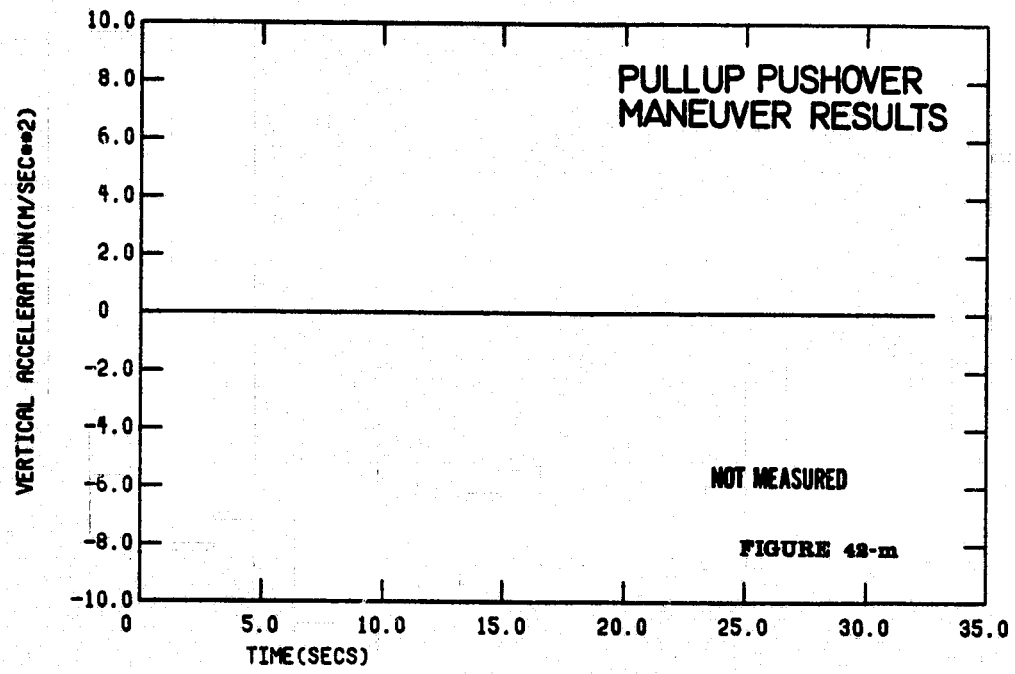


FIGURE 42-m

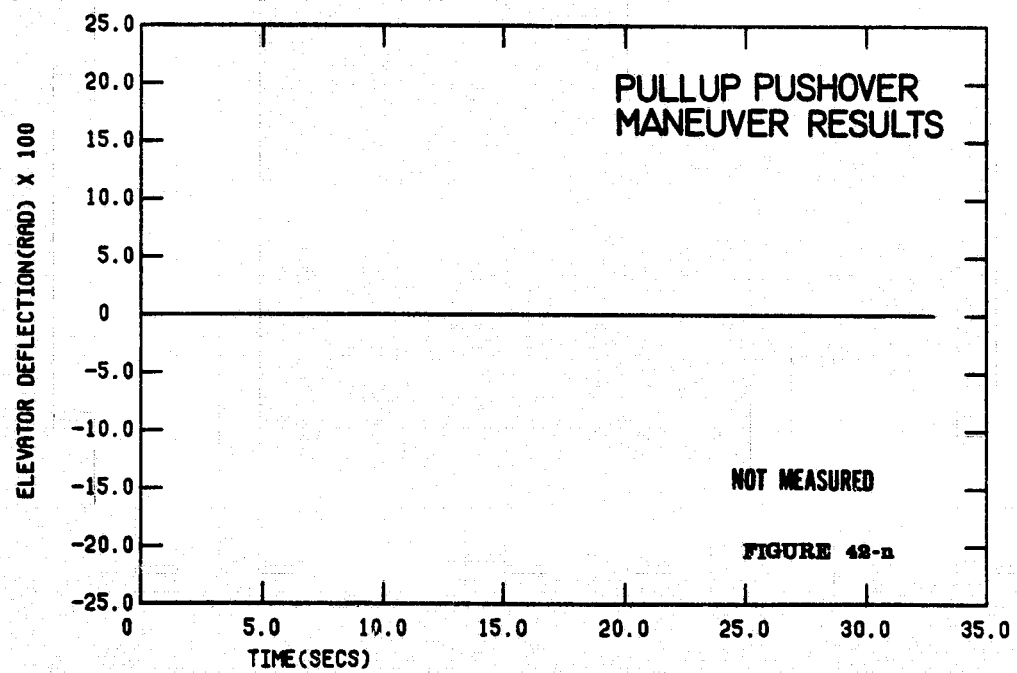


FIGURE 42-n

EXPERIENCE WITH FLIGHT DATA AFTER APPLICATION OF DATA COMPATIBILITY IMPROVEMENT PROCEDURE

Most of the problems encountered attempting to use actual flight data have been enumerated previously. As methods were developed to circumvent the gross inconsistencies present in the data, not surprisingly some smaller problems to the planned utilization of the data began to become apparent. These were of two types. The first is illustrated in figure 43. This shows θ corrected for bias error and drift plotted against the integral of $\dot{\theta}$ corrected for bias error for a pullup-pushover maneuver. Note that the functions begin and end near zero and the peaks lie on the 45° perfect correlation line. In between, however, there is a significant difference between the two measurements. Discussions with the flight crew revealed that it was extremely difficult to maintain a wing-level, yaw-rate-free attitude during the pullup-pushover maneuver. Since in three dimensions

$$\theta(t) = \int_0^t (g \cos \phi - r \sin \phi)dt + \theta_1 ,$$

it is quite apparent that a yaw rate (r) combined with a small bank angle (ϕ) can produce a significant departure in the integral of $\dot{\theta}$, i.e., q from that measured by a free gyro. Similarly, a reasonable bank angle alone can result in the integral of the rate trace being below the attitude gyro indication during pullups and above it during pushovers. This follows simply from the fact that the cos ϕ term decreases the effective pitch rate. Note also that the effect is most pronounced when the pitch rate is greatest. Finally, there is a possibility that one of the gyros is mounted at a slight cant relative to the other, which would produce the same net effect.

The difference shown in figure 43 is sufficient to produce a rather significant difference in the extracted power and drag coefficients if one substitutes $\int\dot{\theta}dt$ for θ in the data submitted to the extraction procedure. For example, at maximum level flight speed the extracted thrust horsepower is about 22% greater if $\int\dot{\theta}dt$ is used than if θ is used. The lower figure is more consistent with that expected, given engine and propeller test data. The fit error with $\int\dot{\theta}dt$ is also about a factor of 2 greater than with θ. For these reasons it seems advisable to employ θ in place of $\int\dot{\theta}dt$.

The second type of problem which became apparent after some experience with the results of the data compatibility procedure is the extent to which one could specify a priori the correct form of the lift and drag models. It had been assumed initially that the maneuvers were sufficiently slow that contributions from terms such as $C_{L_{\dot{\alpha}}}$, $C_{D_{\dot{\alpha}}}$, $C_{D_{\dot{\theta}}}$, and $C_{L_{\dot{\theta}}}$ could be safely ignored. Inclusion of such terms in the model extractions lowered the fit errors by a factor of two or more. Further, the values of $C_{L_{\dot{\alpha}}}$, $C_{L_{\dot{\theta}}}$, etc,

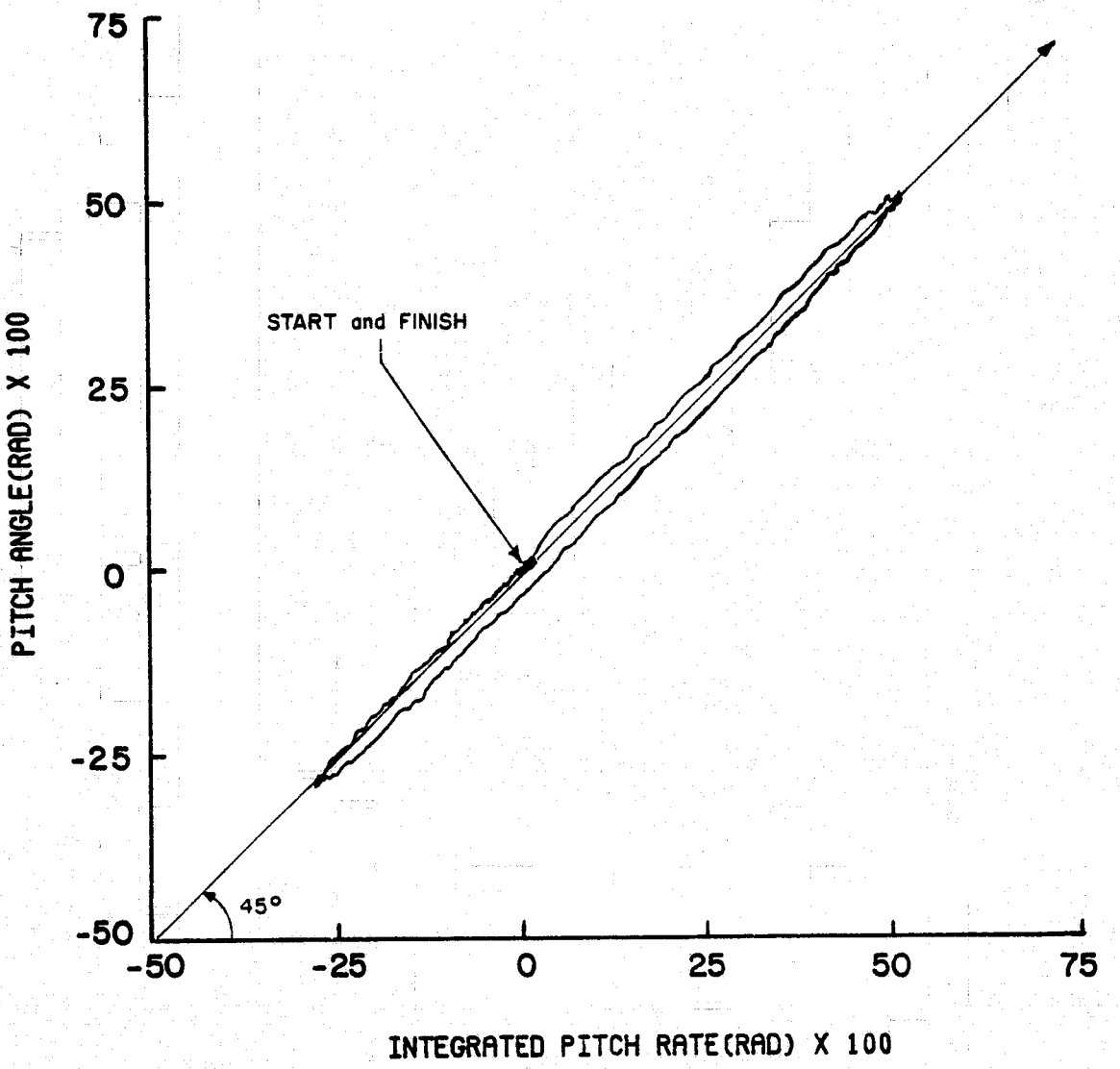

75
50
25
0
-25
-50
-50
-25
0
25
50
75
START and FINISH
45°
PITCH ANGLE(RAD) X 100
INTEGRATED PITCH RATE(RAD) X 100

FIGURE 43

extracted indicated these therms could contribute as much as 10% to the overall C_L or C_D. Thus, it seems desirable to include these terms in the procedure whenever possible. That these terms would be important for the ATLIT airplane was not appreciated until the development work on the Noise Reduction -- Newton-Raphson procedure was almost complete and the end of the grant period was near at hand. Because of the very considerable time necessary to expand the computer program to accommodate these additional parameters, it was not possible to undertake this task for the present report. Instead, an expanded version of the initial least squares parameter extraction procedure was prepared. (MDLCK. See Appendix B for description). Most of the ATLIT results discussed in the next section were obtained using this limited procedure. An assessment of the validity of the parameter values obtained by this procedure can be obtained by comparing the fit error obtained with that found at various stages in the test case (random computation of the α-channel).

OTHER APPROACHES TO THE PROBLEM

Gerlach's Method

While the method described in the present report to find both the drag and the power from accelerated flight data was developed specifically for the ATLIT test program, it is similar in some respects to the scheme outlined by Gerlach (Ref. 9) in a 1970 SAE Business Aircraft Meeting paper. Subsequent results are discussed in Ref. 10. Gerlach assumes, for example, that while the engine brake horsepower is known *a priori* (as a function of manifold pressure and RPM), the actual power into the airstream is a quadratic function of this brake horsepower. His procedure is intended to yield the values of the three coefficients in this quadratic function. Similarly, he assumes a simple parabolic drag polar and a linear lift curve and the procedure is intended to yield values of $C_{D_{min}}$, span efficiency factor, C_{L_α}, and $C_{L_{\alpha=0}}$.

The data time histories used in the extraction process are obtained as follows:

$$\alpha = \theta - \sin^{-1}\left[\frac{\Delta h_p - \int\int_o^{t_f} (Ax \sin\theta - Az\cos\theta - g)dt^2}{\frac{\Delta t}{V}} + \frac{\int_o^t (Ax\sin\theta - Az\cos\theta - g)dt}{V}\right] \tag{152}$$

$$\theta = -\tan^{-1}\frac{Ax}{Az}_{t=0} + \int_o^t \dot{\theta}\, dt \tag{153}$$

Here V is determined by the usual pressure and temperature instrumentation. Δh_p is the total change in altitude represented by the maneuver according to static pressure instrumentation, Δt is the total time of the maneuver, t_f the time at the end of the maneuver and Ax and Az are accelerometer indications along the body axes.

Gerlach indicates that the α, θ, and γ values obtained this way are inadequate because of slight inaccuracies in the determination of initial values and small zero shifts in Ax, Az, and $\dot{\theta}$. He then proceeds to find corrections for these errors by writing:

$$\Delta\Delta h(t) = \Delta\Delta h_0 + \Delta\theta_0 K_1(t) + \Delta\dot{h}_0 K_2(t) + \Delta Ax_0 K_3(t) + Az_0 K_4(t) + \Delta\dot{\theta}_0 K_5(t) + \varepsilon_h \quad (154)$$

where the $\Delta\Delta h(t)$ is the difference in the altitude obtained from pressure data and integration of the accelerometers; $\Delta\theta_0$, ΔAx_0, ΔAz_0, $\Delta\dot{\theta}_0$, $\Delta\dot{h}_0$ are initial bias errors, ε_h is the noise component of $\Delta\Delta h$, and $\Delta\Delta h_0$ is a remaining constant which should turn out to be zero. The variables $K_1 \ldots K_5$ are said to be known functions of time but the method by which they are obtained is not given in the paper. Gerlach performs the same operation with regard to the difference in airspeed obtained from pressure data and accelerometer integrations. Using regression analysis, Gerlach finds corrections to his data. The corrected α, $\dot{\theta}$, h, and V data are then used in a system of equations

$$C_x = C_{x_0} + C_{x_{\Delta P_t}}\left(\frac{\Delta P_t}{\frac{1}{2}\rho V^2}\right) + C_{x_\alpha}\alpha + C_{x_{\alpha^2}}\alpha^2 + C_{x_{\dot{\alpha}}}\frac{\dot{\alpha}\bar{c}}{V} \quad (155)$$

$$C_z = C_{z_0} + C_{z_{\Delta P_t}}\left(\frac{\Delta P_t}{\frac{1}{2}\rho V^2}\right) + C_{z_\alpha}\alpha + C_{z_{\dot{\theta}}}\frac{\dot{\theta}\bar{c}}{V} + C_{z_\delta}\delta_e \quad (156)$$

$$C_m = C_{m_0} + C_{m_{\Delta P_t}}\left(\frac{\Delta P_t}{\frac{1}{2}\rho V^2}\right) + C_{m_\alpha}\alpha + C_{m_{\alpha^2}}\alpha^2 + C_{m_{\dot{\theta}}}\frac{\dot{\theta}\bar{c}}{V} + C_{m_\delta}\delta_e \quad (157)$$

$$\frac{\Delta P_t}{\frac{1}{2}\rho V^2} = a + b\left[\frac{P}{\frac{1}{2}\rho V^3}\right] + c\left[\frac{P}{\frac{1}{2}\rho V^3}\right]^2 \quad (158)$$

Here P is the brake horsepower at a given manifold pressure and RPM, ΔP_t is the change in total pressure at some point in the slipstream, δ_e is the elevator deflection, and a, b, and c are undetermined constants. This gives a total of 19 constants to be determined from four equations. Gerlach does not provide sufficient detail in the paper to identify the procedure by which he extracts these coefficient values but one could employ the least squares procedure by setting

$$C_x = \frac{w(Ax + g\sin\theta)}{g\frac{1}{2}\rho V^2 S}, \quad (159)$$

$$C_z = \frac{w(Az - g\cos\theta)}{g\frac{1}{2}\rho V^2 S}, \text{ and} \quad (160)$$

$$C_m = \frac{\ddot{\theta} I_{YY}}{\bar{C}\frac{1}{2}\rho S V^2} . \qquad (161)$$

The reader will recognize several of these constant coefficients as familiar stability derivatives. Gerlach indicates further that by correcting the data to steady flight conditions by means of the chosen aerodynamic model, one can find the rate of climb as a function of speed, the elevator angle as a function of speed, and the drag polar. The details of the method are not supplied in the paper or the subsequent reference.

How does Gerlach's method compare with the method described in the present report? The latter does not include the pitching degree of freedom so that one cannot use it to extract longitudinal short period stability information as Gerlach does. On the other hand the flight maneuvers used in the present work are chosen so as to experience a large part of the aircraft's angle of attack and speed range rather than "small" perturbations about an equilibrium state from which one would normally extract short period information. Gerlach follows the latter approach. Gerlach apparently chooses integration of accelerations as his method of data smoothing, rather than filtering, and uses regression techniques for the removal of bias errors. A similar approach is followed in the present method to remove bias errors. The application of bias corrections is apparently the only device Gerlach uses to improve interparameter data consistency. He seems to have settled on a single, relatively simple aerodynamic model. The form of the equations to which the regression analysis is applied is also quite different from that employed herein since the equations serve a different purpose. The identification of thrust horsepower as a function of speed is not as evident in Gerlach's approach as in the present method. Finally, the philosophy adopted here is that by limiting one's consideration to motions of the center of gravity in the vertical plane and thus to performance problems alone, the consequent reduction in mathematical complexity should permit one to do a better job sorting out errors in the flight data and extracting thrust horsepower and drag.

Iliff's Method

Iliff (Ref. 12) employed a very interesting variant of his stability analysis procedure to determine lift and drag from pushover-pullup maneuver data. He did not attempt to determine thrust at the same time because "... an independent estimate of thrust is necessary". He assumes the following aerodynamic model

$$C_x = C_{x_o} + C_{x_\alpha}\alpha + C_{x_{\delta_e}}\delta_e + C_{x_{\alpha^2}}\alpha^2 + C_{x_{\alpha\delta_e}}\alpha\delta_e + C_{x_{\delta_e^2}}\delta_e^2 \qquad (162)$$

$$C_z = C_{z_o} + C_{z_\alpha}\,\alpha + C_{z_{\delta_e}}\,\delta_e + C_{z_{\alpha^2}}\,\alpha^2 + C_{z_{\alpha\delta_e}}\,\alpha\delta_e + C_{z_{\delta_e^2}}\,\delta_e^2 \qquad (163)$$

$$C_L = -\,C_z \cos\alpha + C_x \sin\alpha \qquad (164)$$

$$C_D = -\,C_x \cos\alpha - C_z \sin\alpha \qquad (165)$$

and writes the six equations

$$\dot{q} = M_V V + M_q q + M_\alpha \alpha + M_{\alpha 2}\alpha^2 + M_{\delta_e}\delta_e + M_{\delta_e 2}\delta_e^2 + M_{\alpha\delta_e}\alpha\delta_e + M_o \qquad (166)$$

$$\dot{\alpha} = Z_V V + Z_\alpha \alpha + Z_{\alpha 2}\alpha^2 + Z_{\delta_e}\delta_e + Z_{\delta_e 2}\,\delta_e^2 + Z_{\alpha\delta_e}\alpha\delta_e + Z_o + q + \frac{g}{V}\cos\theta_o - \frac{g}{V}\,\theta\sin\theta_o \qquad (167)$$

$$\dot{V} = X_V V + X_\alpha \alpha + X_{\alpha 2}\alpha^2 + X_{\delta_e}\delta_e + X_{\delta_e 2}\delta_e^2 + X_o + \frac{T}{W}\,g - g\sin\theta_o - g\,\theta\cos\theta_o \qquad (168)$$

$$\dot{\theta} = q$$

$$A_z = -\frac{V}{g}(Z_V V + Z_\alpha \alpha + Z_{\alpha 2}\alpha^2 + Z_{\delta_e}\delta_e + Z_{\delta_e 2}\delta_e^2 + Z_{\alpha\delta_e}\alpha\delta_e + Z_o) \qquad (169)$$

$$A_x = \frac{1}{g}(X_V V + X_\alpha \alpha + X_{\alpha 2}\alpha^2 + X_{\delta_e}\delta_e + X_{\delta_e 2}\delta_e^2 + X_{\alpha\delta_e}\alpha\delta_e + X_o + \frac{T}{W}\,g) \qquad (170)$$

δ_e, V, q, α, θ, $\dot{q}$, A_z, and A_x are available as measured functions of time and T, the net thrust, W, and θ_o are taken as constants which are assumed known during a given maneuver. If one calls α^2, $\alpha\delta_e$, and θ separate variables distinct from α and $\dot{\theta}$, then by specifying δ_e as a function of time, one has a system of six equations with constant coefficients which can be solved for

$q(t)$
$\alpha(t)$
$V(t)$
$\theta(t)$
$\alpha^2(t)$
$\alpha\delta_e(t)$,

provided values of the constant coefficients are supplied. Since the equations are linear, the general form of the solution may be written down immediately and the partial derivatives for the Newton-Raphson equations evaluated by substitution of these solutions in the analytical expressions or evaluated numerically by finite differences. The cost function to be minimized is constructed of differences squared between the measured and computed values of q, α, V, θ, $\dot{q}$, A_z, and A_x. The minimization is achieved when the constant coefficients, M_q, M_V, M_α, etc., assume those values which produce solutions to the system of six equations most nearly matching the measured data in a least squares sense.

In the form presented in the paper, Iliff solves for the values of 22 constants and 7 measurement biases. These include the 12 constants necessary to evaluate $C_x = x/(\frac{1}{2}\rho SV^2)$ and $C_z = Z/(\frac{1}{2}\rho SV^2)$. Note that the thrust must be known a priori in order to separate X_o from the constant $\frac{1}{g}(X_o + \frac{T}{W}g)$. X_o, of course, is the major contributor to C_{D_o}. Iliff also assumes that the thrust axis is coincident with the x-body axis and his formulation is in terms of a body axis system rather then a wind axis system as used here.

The acceleration equations as written are for true accelerations; hence, the gravitational contributions to the usual instrument indications must first be removed before they are used in the minimization.

Iliff's model includes three non-linear terms which he is able to accommodate by writing three additional equations and calling these non-linear terms additional linear variables. Obviously, this process cannot be continued to a significant degree so that he must content himself with fairly simple lift and drag models if he is to avoid the non-linear solution techniques followed in the present work. This means that he must limit himself to maneuvers sufficiently restricted that the changes in all the variables are linear. He cannot evaluate the entire lift and drag curves in a single maneuver if the non-linearities of the complete curves extend beyond the form chosen. In the present work somewhat more complex models are investigated. In Iliff's formulation only small excusions in pitch angle about the initial value are permitted. That restriction does not exist in the present formulation. Iliff's as well as the present models do not include rate terms. One final difference is the inclusion of $C_{x_{\delta_e}}$, $C_{x_{\alpha\delta_e}}$, and $C_{x_{\delta_e^2}}$ terms in the drag expression; those terms are not included explicitly in the present formulation. It was pointed out earlier, however, that for a given weight and c.g. location these effects would be included implicitly by the nature of the extraction process in the coefficients of the drag expression. The values of these coefficients in the present formulation would, therefore, be expected to change with changes in c.g. location or weight.

The Iliff paper illustrates very clearly the trade offs involved in activities of this type. If one is content with restricted aerodynamic models, evaluation over a limited speed range, and no thrust determination, then the trajectory computation is very much simpler. Since trajectory evaluation consumes at least 75% of the computational time and is responsible for much of the error in the present procedure, the time and accuracy advantage of the simpler procedure cannot be dismissed easily.

Some of Iliff's more recent studies in parameter estimation applied to stability and control problems are reported in references 13, 14, and 15. Other minimization algorithms are described in reference 16.

C-3

DISCUSSION OF RESULTS

Figure 44 presents the two data sets from which the lift, drag, and power data shown in figures 45, 46, and 47 were obtained. The drift value shown for the pullup-pushover maneuver was chosen after several trials to produce a good match between the measured velocity and the computed value. The α-gain and α-bias values used are those found by the flight calibration of the α-vane for the position error. The rough α-curve is the measured α values as modified by this calibration. The smooth α-curve is the filtered α data modified by the compatibility improvement scheme. The modification is responsible for the difference one sees between the peak measured values and the smooth values. The smooth curve on the θ plot is that produced from the input data by the filtering procedure. The $\dot{h}$ curve is obtained by differentiation of the fourier series representations of h.

To obtain the velocity match shown for the level flight acceleration it was necessary to employ a non-linear θ drift, one for which almost all the effect occurs in the last half of the maneuver. Note also that this drift has the opposite sign from that required with the pullup-pushover, an indication perhaps, of the random nature of the "drift". It would appear from the figure, however, that some further refinement of the non-linear drift function is necessary in order to achieve a really acceptable match.

Figure 46a shows the extracted drag coefficient values obtained with three different models for the pullup-pushover manuever. Only the steady state components are plotted to facilitate comparison with the results of Holmes (Ref. 11) and the predictions. However, the complete drag coefficient expression obtained, including the rate terms, is shown on the figure. The power expressions associated with each of the extracted drag results are shown in figure 47a. It will be observed that the model giving the lowest fit error obviously is not an accurate representation of the aircraft's thrust horsepower. If one assumes that the drag found by Holmes is approximately correct, then it is seen that result (a) provides the best fit by best straddling the actual drag. The most reasonable power expression, (c), lies below both the expected power and the steady-state drag for all values and hence has the largest fit error. We may remark here that the fit error obtained by including the rate terms in the drag and power expressions is almost an order of magnitude smaller than the fit error for the same expressions without any of the rate terms.

A number of other power models, for example

$$P = P_o \ln V_1$$

$$P = P_o + P_2 V + P_3 V^2 \text{ , and}$$

$$P = P_o + P_1 V^x$$

where x has various values from 0.2 to 0.6, were investigated with no apparent improvement in the results.

The estimated power shown in figure 47a for 256 fps would appear to be consistent with the drag coefficient near $\alpha = 0$ shown in figure 46a, because the extracted power and drag values for model (c) -- which are related by an equation -- are both approximately the same as these values. At the low speed end of the data the estimated power is either a little low or the drag value derived from Ref. 11 is a little high or both. A power value of 103,000 ft-lbs/sec at 167 ft/sec is consistent with a drag coefficient value of about 0.98 at an $\alpha = 0.104$.

One explanation for the failure of the extracted values to agree better with what are probably reasonable power and drag is a possible error in the α position error calibration. The extraction process is, of course, more sensitive to the value of α than to the value of any other variable. As an experiment an extraction was performed on a data set with a larger value of α gain along with a negative bias value. The resulting α values were therefore centered about those used for the present extraction. Interestingly, the extracted power curve using model (c) had a considerably shallower slope than the result shown in figure 47a. Since the calculated flight velocity is not particularly sensitive to the values of α used in integrating the kinematic equation, it seems possible that an adjustment to α sufficient to bring the extracted results into much better agreement with the "accepted" values can be achieved while preserving the congruence between the calculated velocity and the measured value.

We may note in passing that the aircraft was flown in a rather "dirty" condition. This fact is no doubt primarily responsible for the measured drag being much greater ($\sim$ 25%) than the predicted value. When the aircraft was "cleaned up" for the full-scale wind tunnel tests the measured drag was found to be about 15% less* than the predicted value.

Figure 46b shows the extracted drag coefficients obtained from the level flight acceleration at 4000' depicted in figure 44. To obtain this result it was necessary to omit the rate terms from the drag model but retain them for the power expression. Note that the speed range and angle of attack range covered by the two data sets are approximately the same. The rates at which the variables change, of course, are much lower in the level flight acceleration. It would appear that the rates are below whatever threshold value is needed to give meaningful extractions. Also the fit error -- extrapolated to the same number of data points -- is about three times as large for the level flight acceleration as for the pullup-pushover. This would seem to indicate that maneuvers featuring more rapid parameter changes or larger parameter changes make possible more accurate coefficient extractions. They also aid in masking data measuring and acquisition defects. The ideal maneuvers, however, should not be so rapid as to excite more unsteady aerodynamic effects or so large as to uncover even more non-linearities.

*Private communication.

The value of C_{D_o} found from the level flight acceleration is 7.5% lower than that recovered from the pullup-pushover. Considering the fact that fit errors for both data sets are still excessive, this agreement is quite good. This value (0.0468) is about 13% below that given by Holmes. The uncharacteristic variation in the drag coefficient with angle of attack is indicative of a problem in the data submitted to the extraction routine. Note that in figure 44 the match between the measured and computed values of velocity is much poorer than for the pullup-pushover. In addition a much more unusual "drift" correction to θ was required to achieve even this level of congruence. One might suggest that perhaps a relatively low frequency gust to which the α vane responded more completely than did the aircraft (hence θ and $\dot{\theta}$) as a whole was responsible for spurious contributions to the computed aircraft velocity. Analysis of several more maneuvers would be required to determine the validity of this contention. In any event, the extracted variation of C_D with α for the level flight acceleration must, for the present, be regarded as having the correct order of magnitude and little more.

The failure of the extracted power values shown in figure 47b to agree more closely with those extrapolated from sea level full scale wind tunnel results is another indication of the higher level of error present in the level flight acceleration data set. Qualitatively, however, the power results are similar to those for the pullup-pushover, a favorable indication. There is some evidence also that the estimated power value for 4000' is perhaps just a little larger than is actually the case. Note the relatively good agreement obtained for $\alpha \to 0$ during the pullup-pushover. If the power and drag are in approximate equilibrium at $\alpha \approx 0.01$ and if the C_{D_o} value here is about 0.053, then one would expect a power into the airstream of about 149,000 ft-lbs/sec while the extimated value is about 153,000 ft-lbs/sec.

The differences between the extracted values and those determined from speed power measurements are about what one would expect, given the magnitude of the fit error. It was noted during the discussion of the computed theoretical case that a fit error of about 4×10^{-5} for 300 points (30 seconds of data) would be equivalent to an error of about 5% in drag or power. The fit error of 4×10^{-4} for 300 points in the pullup-pushover indicates a power or drag error of about 15%, which is about that found. A fit error of 2×10^{-3} for 450 points in the level flight acceleration indicates an error of about 30%. The extracted power values appear to differ by about 20% from the extimated values while the drag coefficient values are on the average about 40% below the values of Ref. 11.

Some 30 different aerodynamic models were investigated in an effort to reduce the fit error. None showed a significantly lower error while also yielding a reasonable C_{D_o} value. On the basis of these results one must conclude that the reason for the high fit error is more likely to be found in the lack of internal consistency in the data for this particular maneuver than it is in the failure to identify an appropriate aerodynamic model.

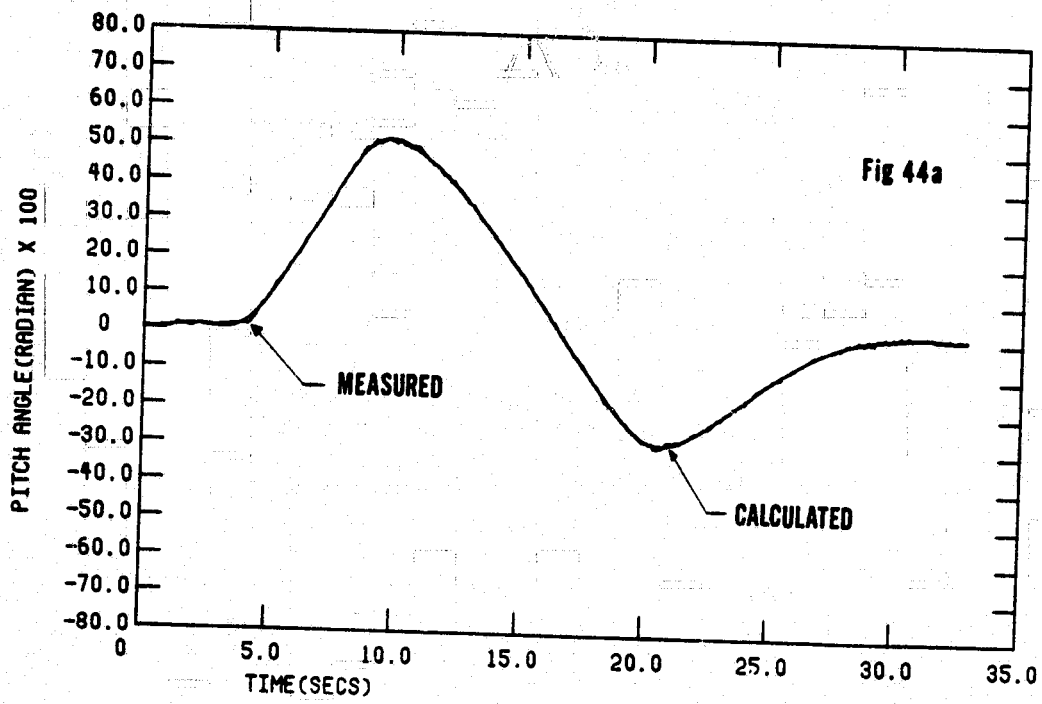
The importance of choosing a satisfactory model is illustrated by the results of an experiment using theoretical trajectory data. (Figure 22). The last term in the 5 term drag model was changed from α^6 to α^4. This single change caused the fit error to increase fifteen orders of magnitude. The coefficients to the other terms in both the drag and power models also changed significantly. C_{D_o}, for example, almost doubled. This extreme sensitivity to small changes in the model is a consequence of the ill-conditioned nature of the "A" matrix in the least squares procedure.

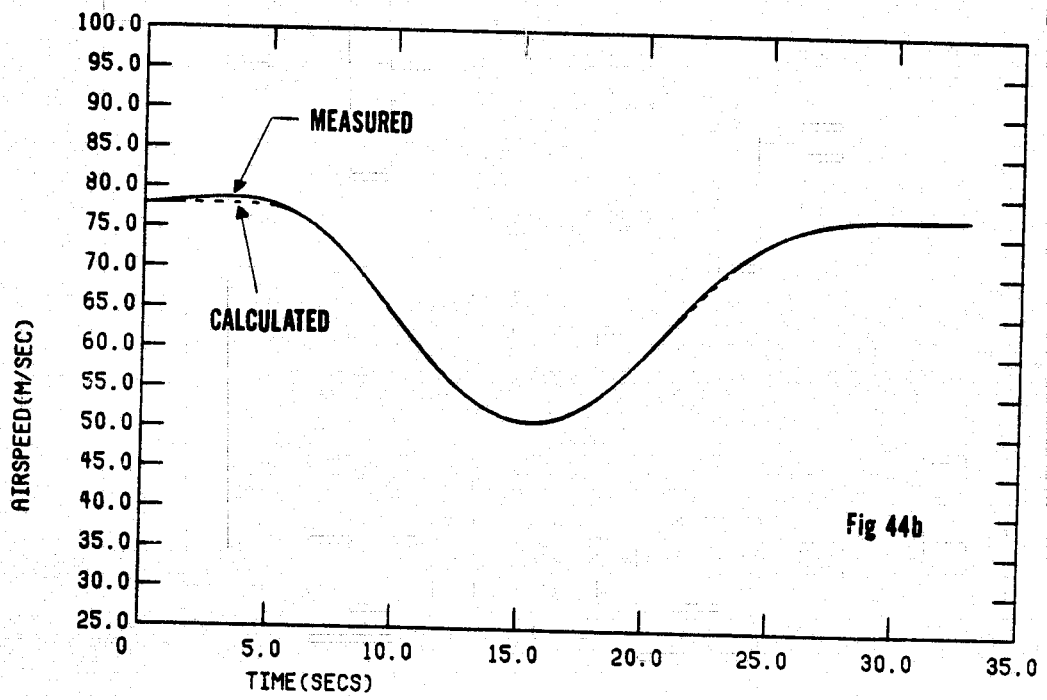
The extracted values of lift coefficient vs. α are shown in figure 45 along with the predicted values and the results of Holmes (Ref. 11). The extraction models used did <u>not</u> include rate terms. The values of $C_{L_{\alpha=0}}$ extracted from the pullup-pushover is about 7% higher than Holmes' result while that obtained from the level flight acceleration is about 10% high. Except for the upward curvature in the result extracted from the level flight acceleration the two maneuvers gave essentially the same lift result. The curvature in the level flight result is thought to be due to the failure of the "drift" model used to produce a better match between the measured and the computed flight velocities. (See figure 44).

The agreement between the extracted result and the steady state results of Holmes is good for $\alpha < 0.02$ radians, the highest speeds of the data sets. Elsewhere, the present results exhibit a lower lift slope. The extracted value of C_{L_α} is even smaller than predicted. The reason for this is uncertain but several possibilities come to mind: (a) the lift model does not account for the excess power available at the lower speeds in the form rate terms. (b) the excess power available may reduce the span efficiency by moving the load inboard. (c) the down thrust due to offset of the thrust axis may be greater than thought. Which, if any, of these is correct can be determined only after further study. Both the pullup-pushover maneuver and the steady speed-power data of Holmes indicate that the lift curve is essentially linear for $\alpha \leq 0.1$. This is fortunate since significant reductions in the complexity of subsequent calculations can be obtained by employing a linear lift curve model.

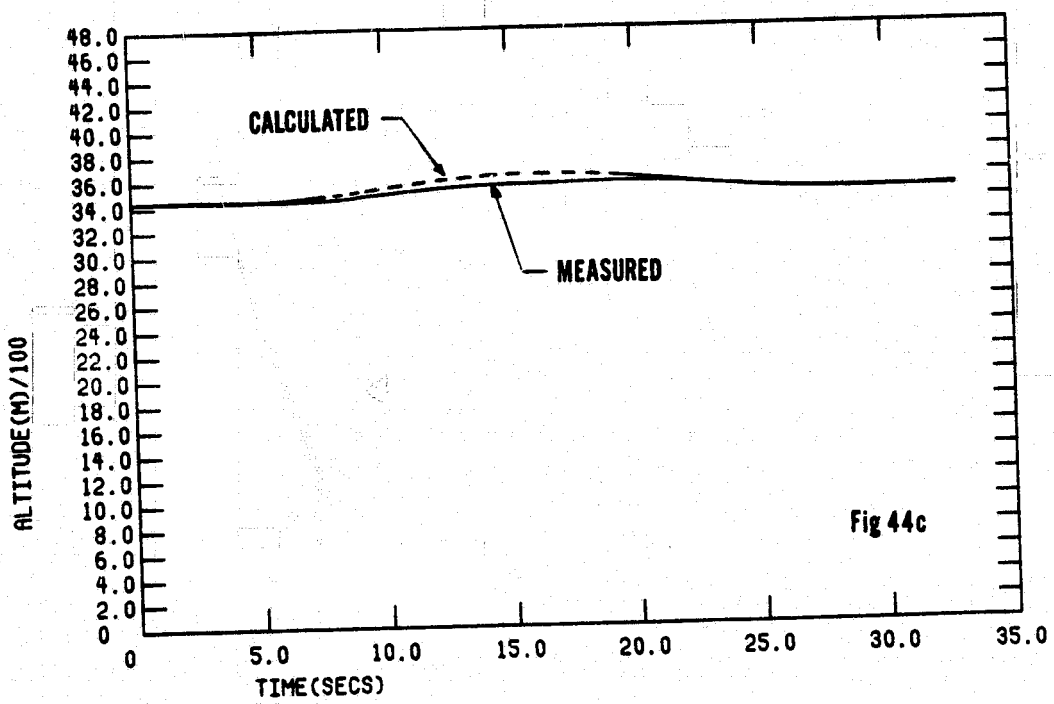
Obviously, the prediction for $C_{L_{\alpha=o}}$ is in error. This would seem to indicate that (a) the wing incidence angle is different from that assumed in developing the prediction, (b) the airfoil trailing edge shape is different from nominal, (c) the instrument reference line is different from that assumed to be the reference in developing the prediction, or (d) some combination of the above. Because, of the large difference which manifested itself in this case, $C_{L_{\alpha=0}}$ is a factor which should be checked closely when developing predictions.

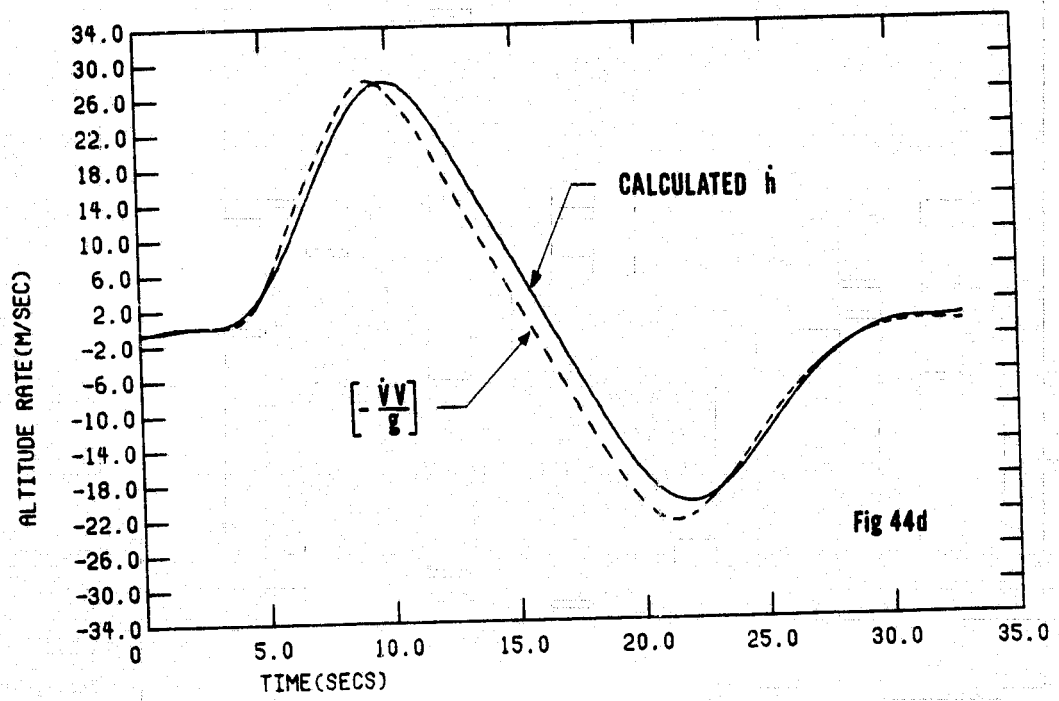
The 13.5% increase in C_{L_α} over the predicted value would appear to be due the higher than nominal dynamic pressures over those areas of the wing swept by the propeller slipstream, an effect not included in the prediction. The area affected and the magnitude of the increase in dynamic pressure can probably be determined adequately by propeller momentum theory. These effects should be included in future predictions.



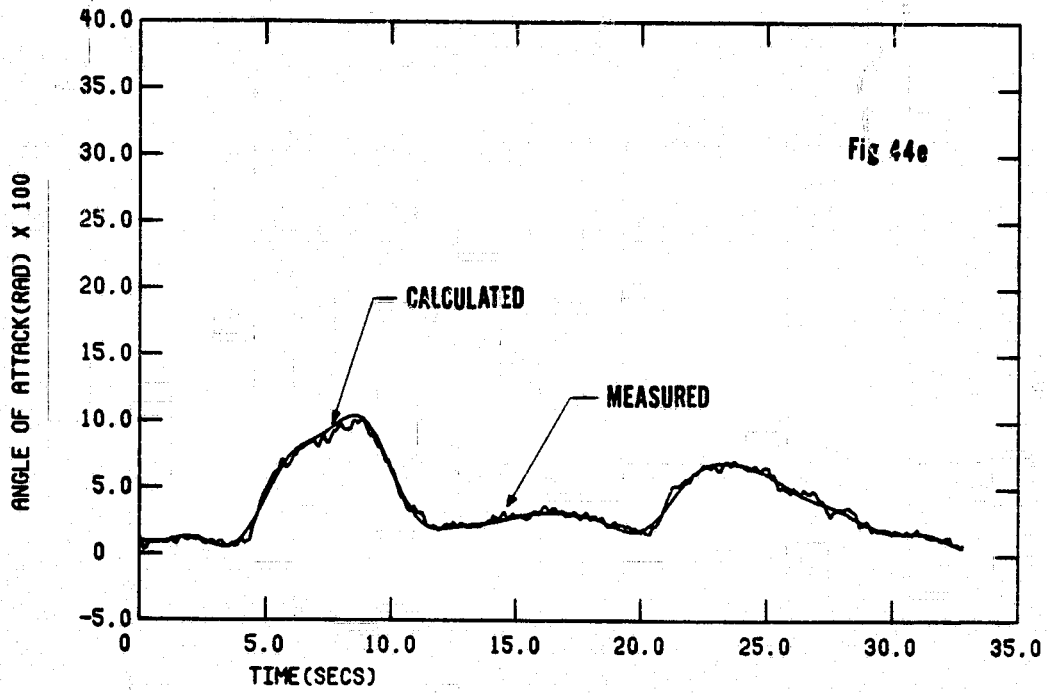


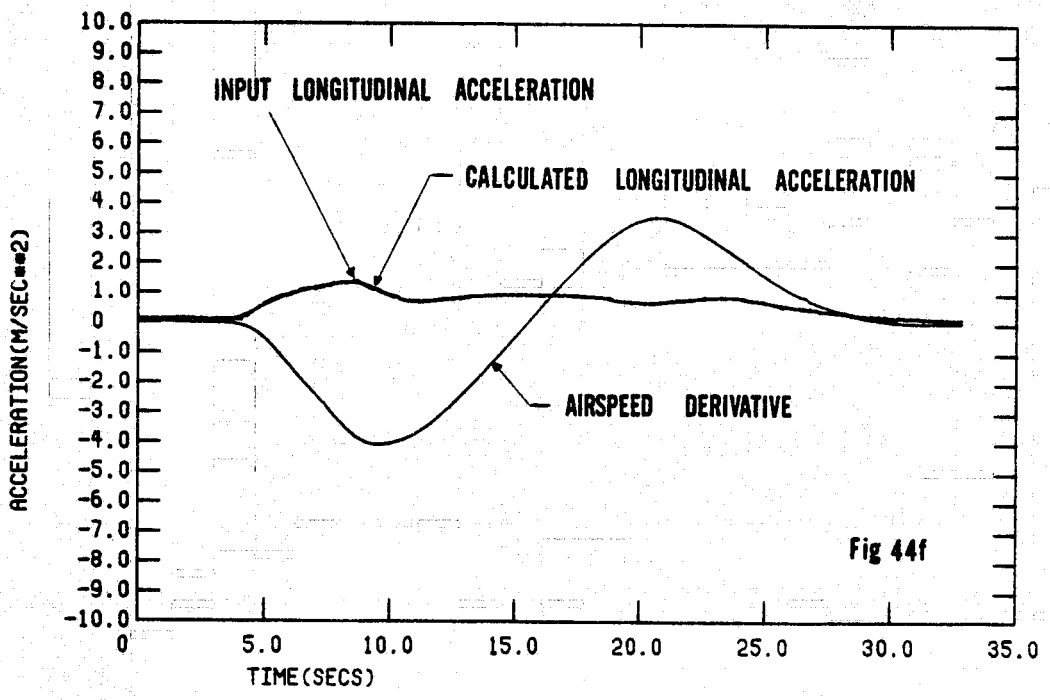
PULLUP-PUSHOVER MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER.
POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01. θ_{DRIFT} = -0.028 RAD.



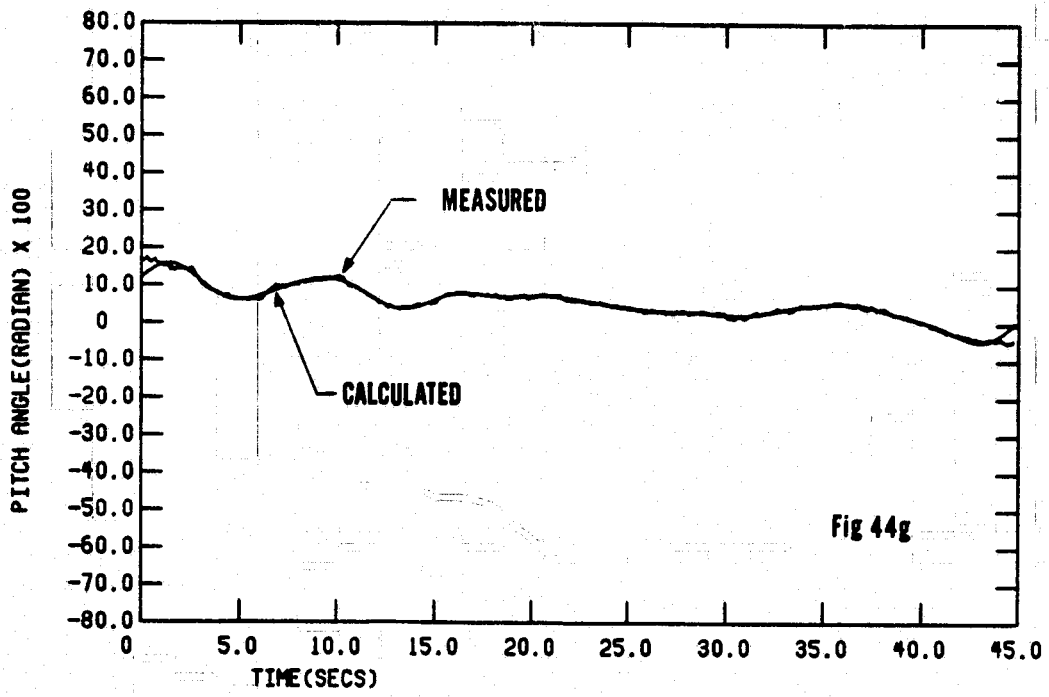


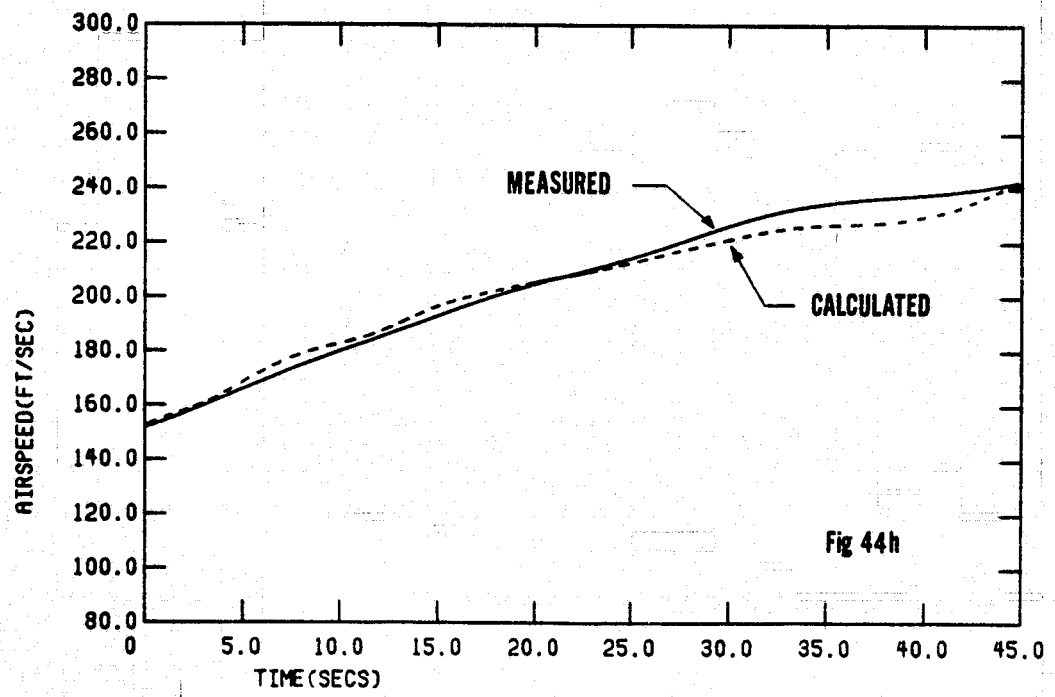
PULLUP-PUSHOVER MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER.
POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01. θ_{DRIFT} = -0.028 RAD.



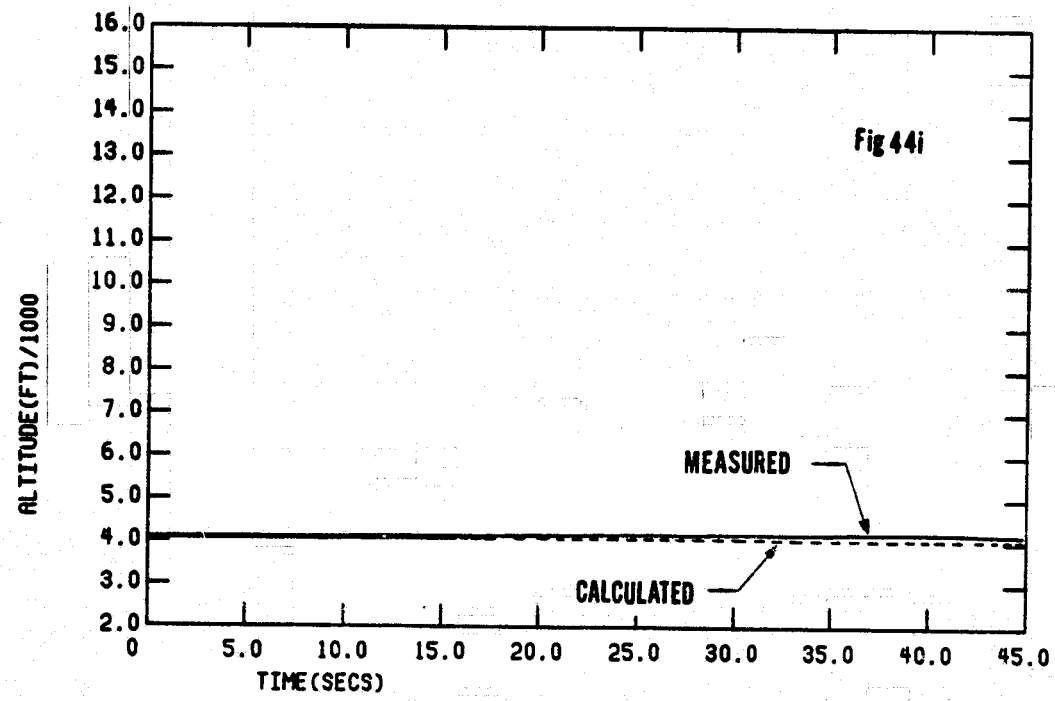


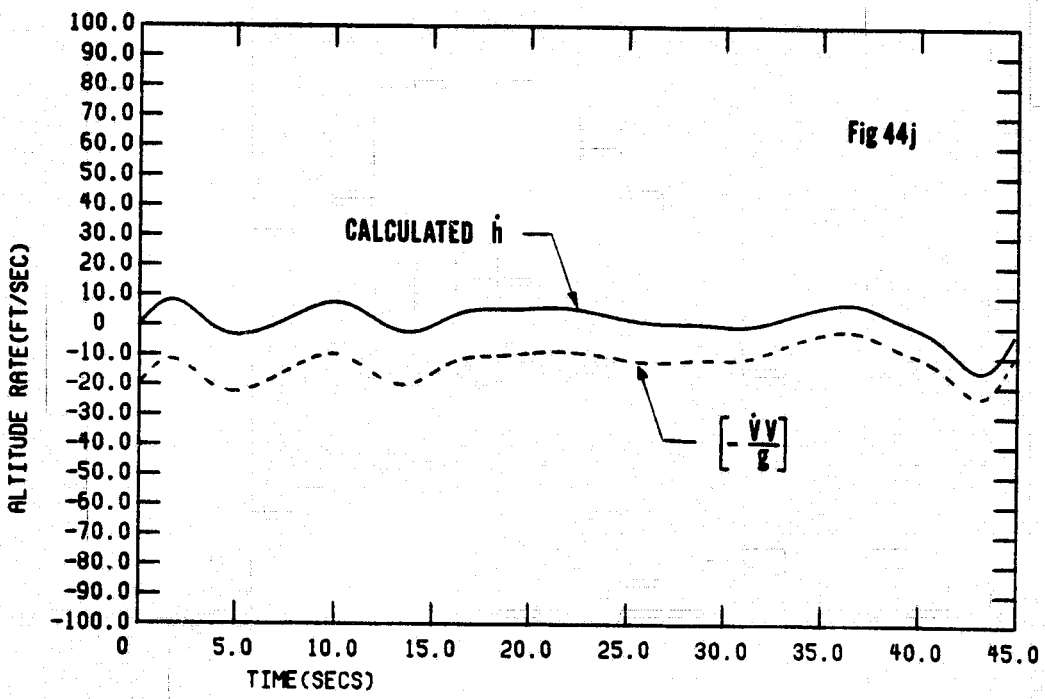
PULLUP-PUSHOVER MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER.
POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01. θ_{DRIFT} = -0.028 RAD.



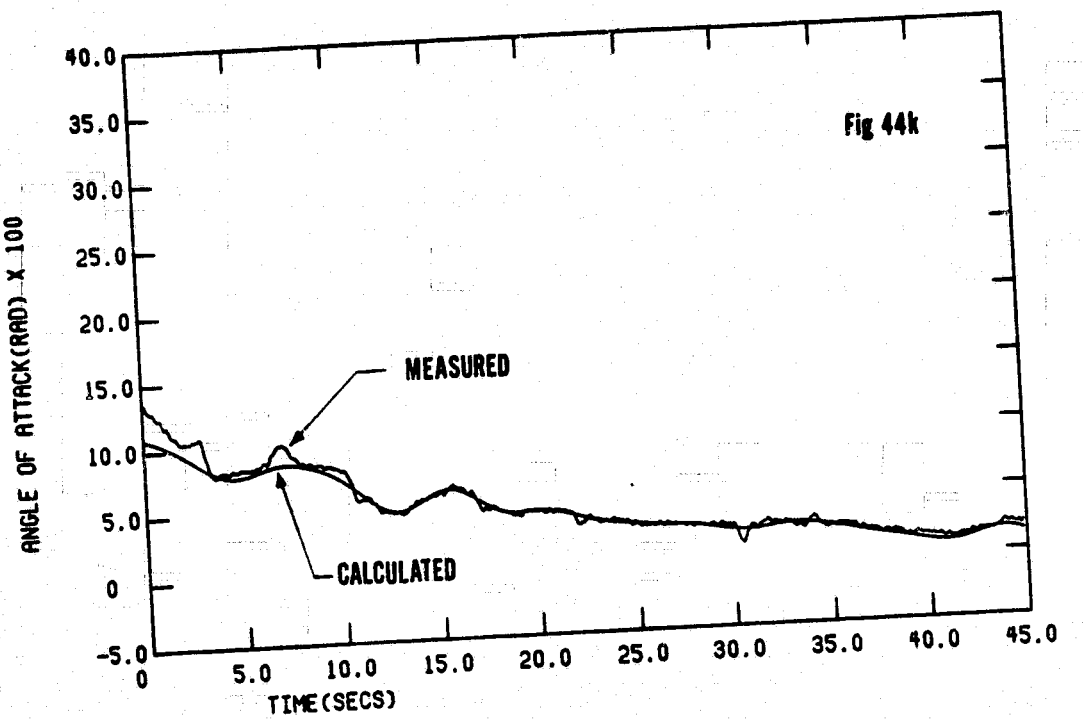


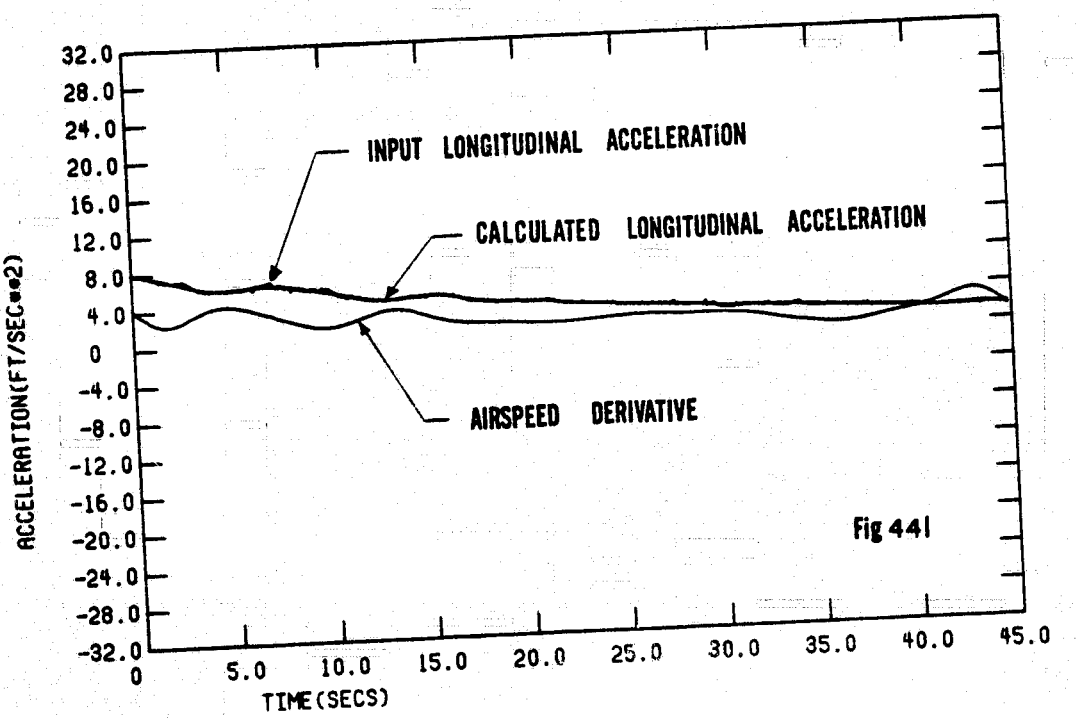
LEVEL-FLIGHT-ACCELERATION MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER. POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01, θ_{DRIFT} = -.10 RAD. (SEE TEXT)





LEVEL-FLIGHT-ACCELERATION MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER. POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01, θ_{DRIFT} = -.10 RAD. (SEE TEXT)





LEVEL-FLIGHT-ACCELERATION MANEUVER ANALYZED FOR LIFT, DRAG, AND POWER. POSITION ERROR CORRECTION: GAIN = 0.8667, BIAS = 0.01, θ_{DRIFT} = -.10 RAD. (SEE TEXT)

STEADY STATE LIFT COEFFICIENT EXTRACTED FROM MANEUVERING FLIGHT

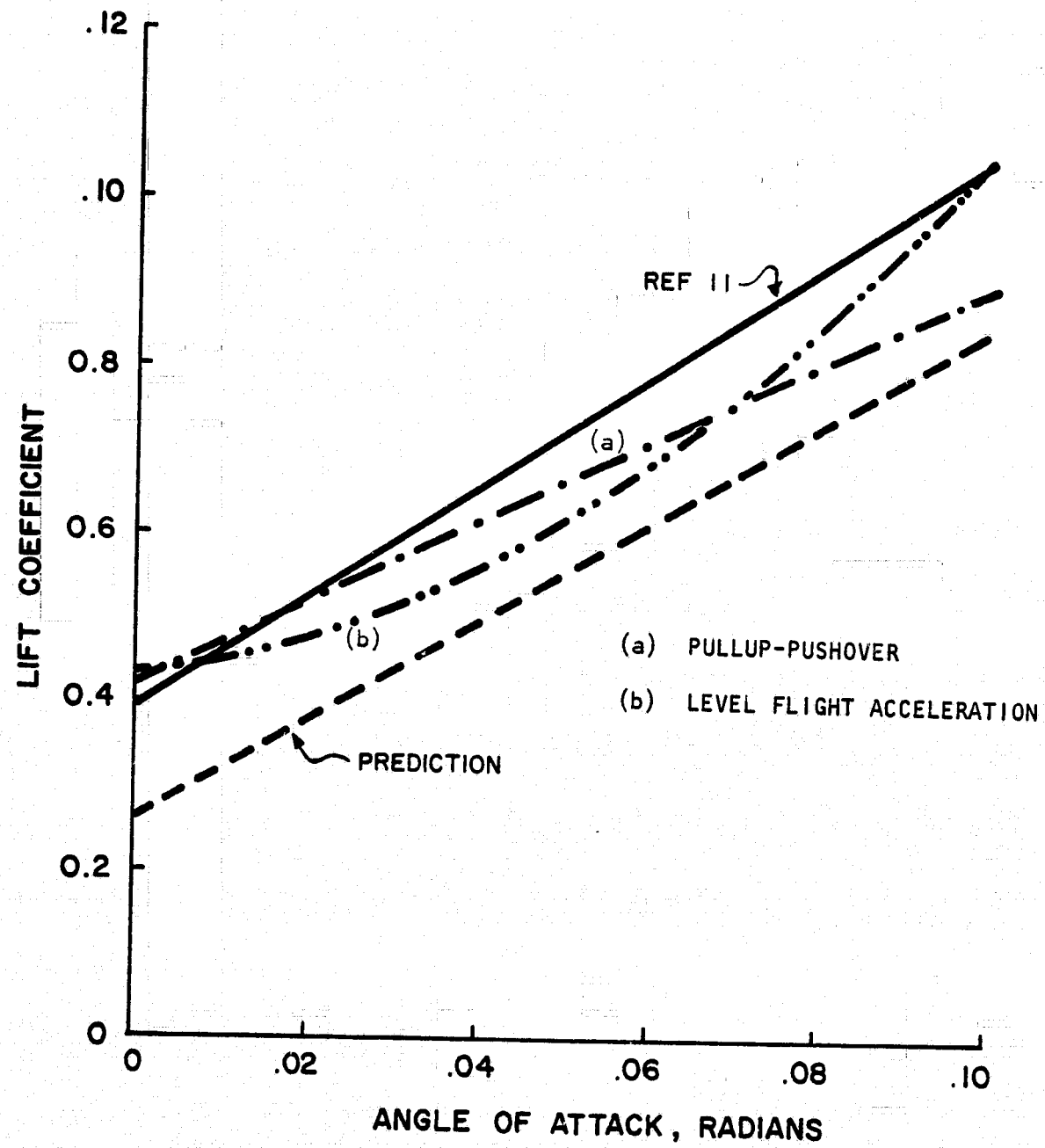


FIG 45

STEADY STATE DRAG COEFFICIENT EXTRACTED
FROM PULLUP - PUSHOVER AT 11,000'

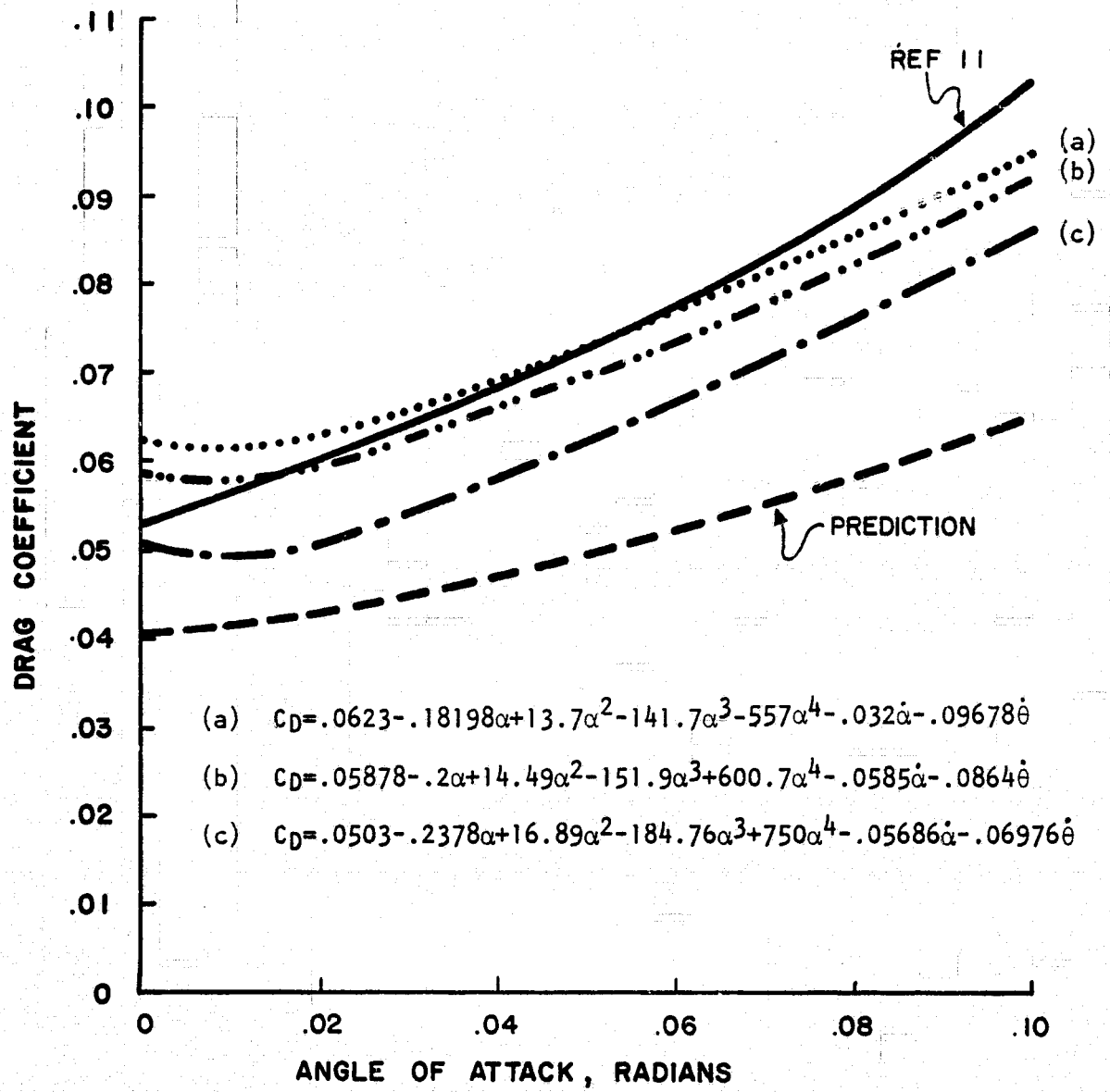


FIG 46a

STEADY STATE DRAG COEFFICIENT EXTRACTED FROM LEVEL FLIGHT ACCELERATION AT 4000'

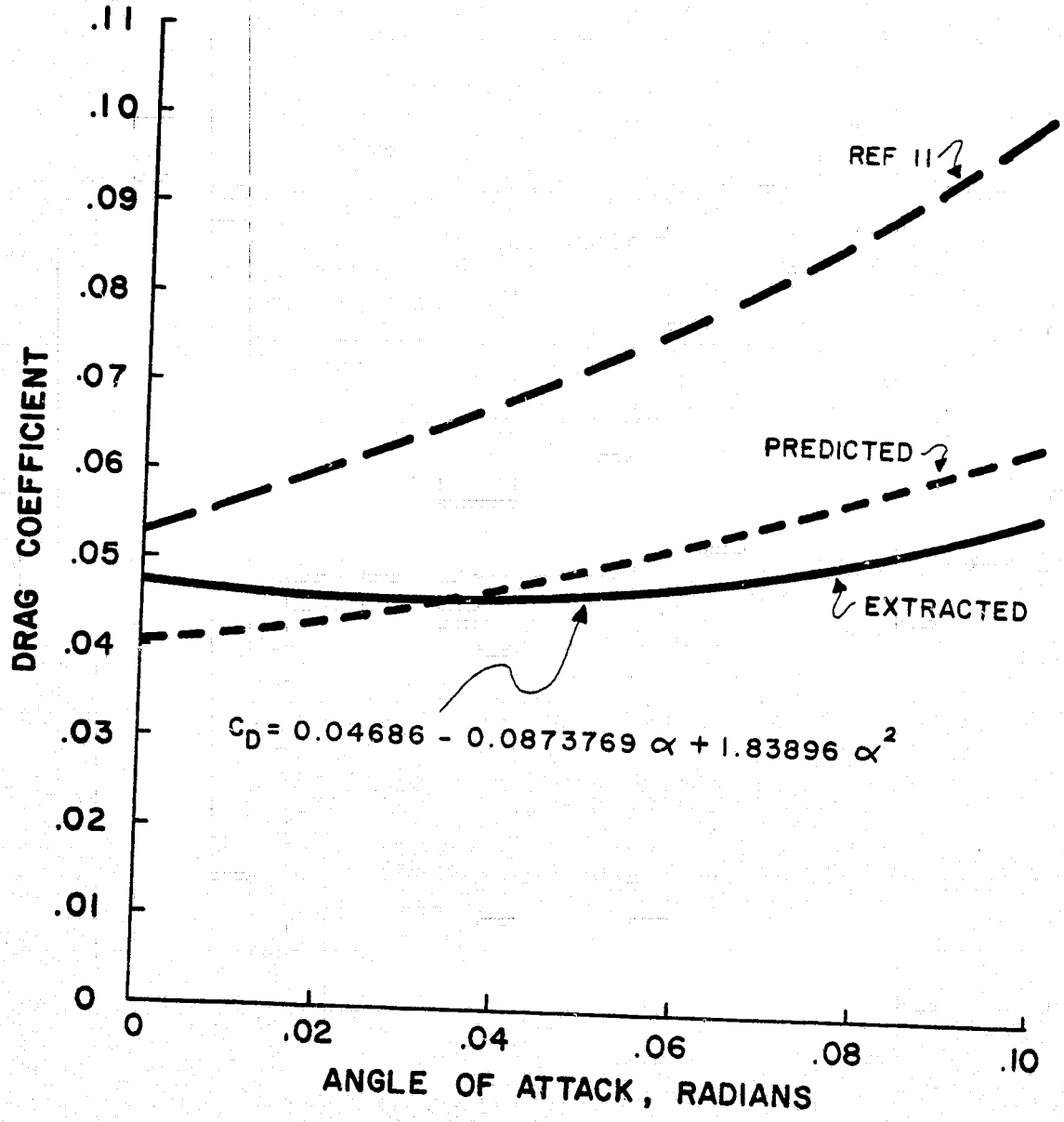


FIG 46b

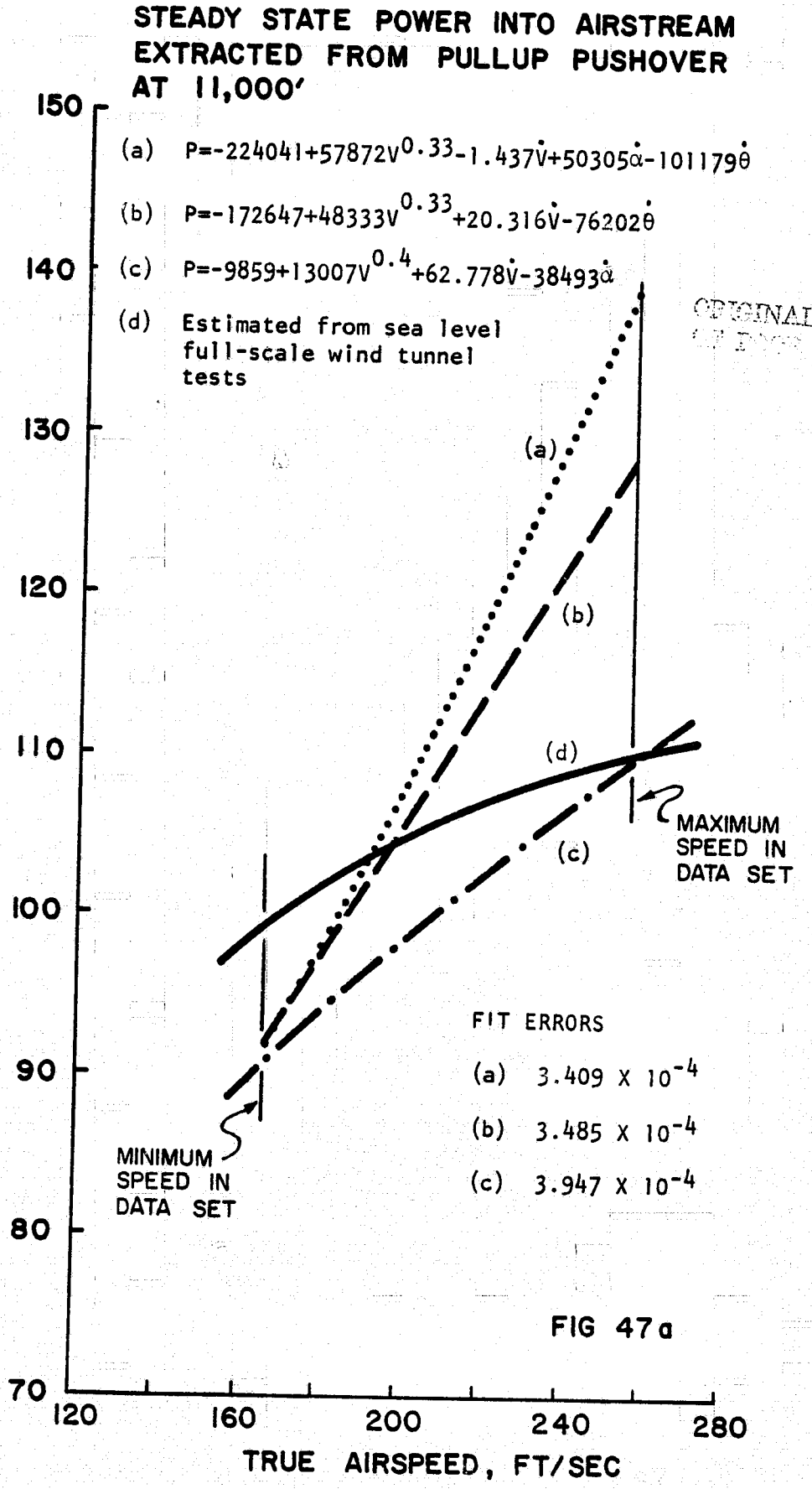

STEADY STATE POWER INTO AIRSTREAM EXTRACTED FROM PULLUP PUSHOVER AT 11,000′
(a) P=-224041+57872V^0.33-1.437V̇+50305α̇-101179θ̇
(b) P=-172647+48333V^0.33+20.316V̇-76202θ̇
(c) P=-9859+13007V^0.4+62.778V̇-38493α̇
(d) Estimated from sea level full-scale wind tunnel tests
ORIGINAL PAGE IS OF POOR QUALITY
150
140
130
120
110
100
90
80
70
(a)
(b)
(c)
(d)
MAXIMUM SPEED IN DATA SET
MINIMUM SPEED IN DATA SET
FIT ERRORS
(a) 3.409 X 10^-4
(b) 3.485 X 10^-4
(c) 3.947 X 10^-4
120
160
200
240
280
TRUE AIRSPEED, FT/SEC

FIG 47a

STEADY STATE POWER INTO AIRSTREAM EXTRACTED FROM LEVEL FLIGHT ACCELERATION AT 4000'

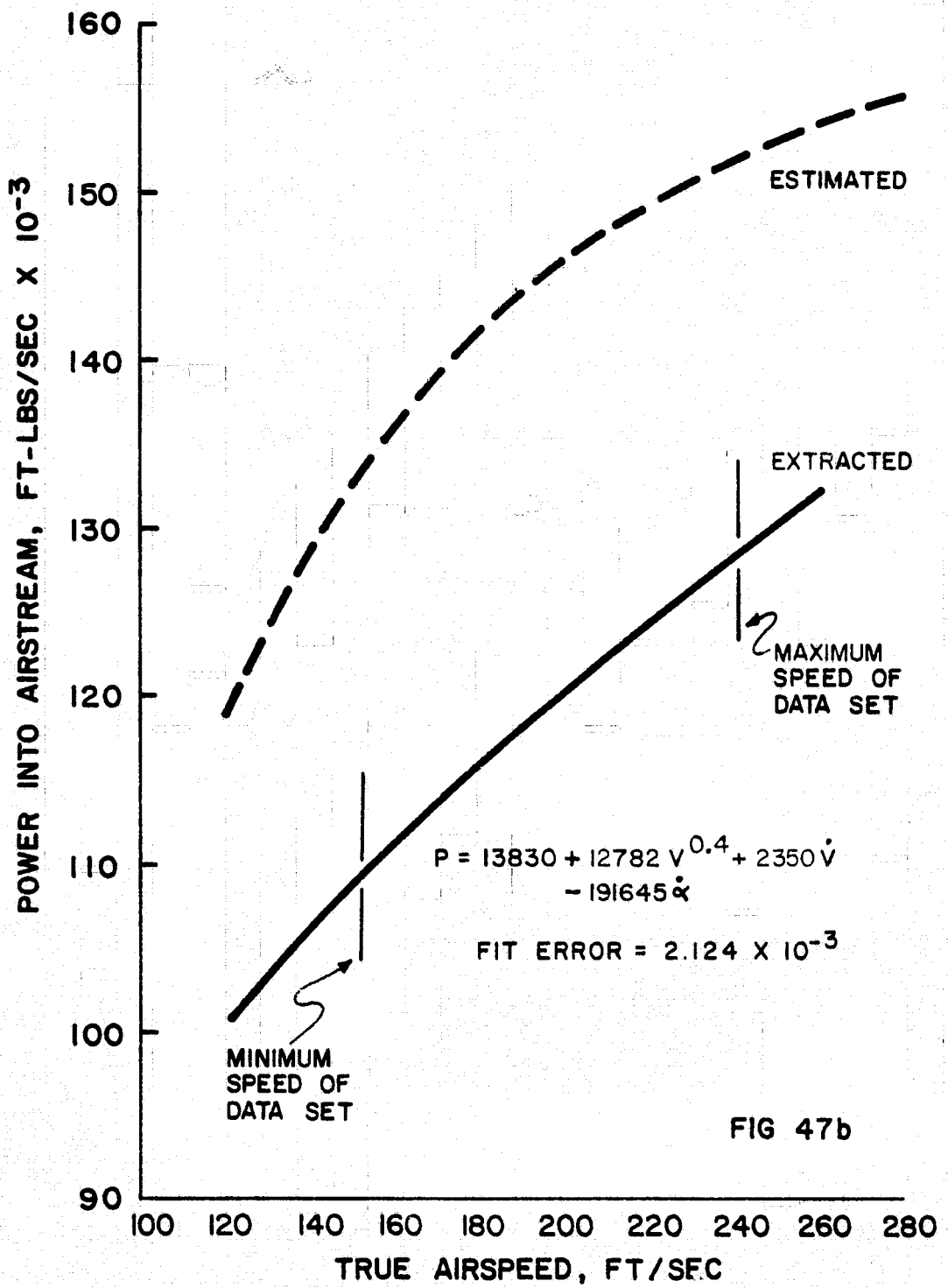


FIG 47b

A NOTE ON STABILITY AND PERFORMANCE EVALUATION

It had been planned to use the lift, drag, and power data extracted from typical maneuvers such as pullup-pushovers to evaluate the aircraft performance parameters. This procedure is analogous to that followed during prediction of the aircraft's performance except that one now substitutes the extracted or measured values of the lift, drag, and power for the estimated values. If extractions are carried out for several altitudes, several power settings, and several configurations, a rather complete picture of the aircraft's performance potential can be developed. However, because of the limited accuracy obtained thus far for the lift, drag, and power in flight as well as the limited number of maneuvers analyzed, this plan was not pursued.

It had also been planned to use the Iliff-Taylor program (Ref. 6) to extract stability derivative values from flight records. Some short stabilator, aileron, and rudder pulse maneuvers suitable for this purpose were flown. It was intended that at least the stabilator pulse records be processed through both FDR1 and FDR2 so as to make them as internally self-consistent as possible. FDR2 is, in fact, provided with a means of arranging the final version of the data in a form suitable for additional processing (punched cards or tape). Because of difficulties in defining adequate lift, drag, and power models and in lowering the fit errors, this plan was also aborted.

The reader interested in comparing the predicted with the measured performance and stability should be aware that full scale wind tunnel tests of the aircraft have been run at the Langley Research Center. Publication of the test results is expected in the near future. Researchers at the Langley Research Center have also been attempting to extract stability derivative values from the flight data by several techniques. It is understood they have also been stymied thus far by the problem of internally inconsistent data. The steady flight test results are available in Holmes (Ref. 11).

CONCLUSIONS

1. A technique has been developed which has demonstrated the ability to extract complete lift, drag, and thrust horsepower curves simultaneously from simulated time histories of a single aircraft maneuver covering the entire speed range.

2. The technique presently does not include rate terms in the model of the aircraft and these may be necessary in real world situations.

3. The technique requires rather accurate input data in order to yield acceptable results.

4. Some success has been achieved in developing an input data compatibility improvement routine.

5. The extraction technique is apparently quite sensitive to small computational errors and should therefore be run with the maximum precision available.

6. Preliminary results indicate reasonable agreement with other flight test techniques and extrapolations of full scale wind tunnel tests even though the trajectory matching features of the technique could not be used because these do not include rate terms in the model of the aircraft at the present time.

SUGGESTIONS FOR FUTURE WORK

It will be apparent to the careful reader that a proper understanding of the correct or best power model for this airplane has not yet been achieved. Until it is, FDR2 cannot hope to yield results with low fit errors. In this connection it would be desirable to employ a non-linear least squares technique -- one which calculates its own exponent values for at least the velocity dependence of the thrust horsepower -- to determine how the data can be fit more effectively. Note that an initial fit error about 10 times lower than that currently obtained will be necessary before FDR2 can proceed satisfactory.

If, as now seems likely, the rate terms are sufficiently important as to require inclusion in the aircraft model, FDR2 will require substantial revision to provide for these terms in the various routines. Because of the complexity they will introduce in HPATH if included as variables it may be desirable to assume that the coefficients for the rate terms are "frozen" so far as HPATH (see Appendix C) is concerned.

Much of the difficulty encountered in obtaining convergence of the trajectory match procedure is thought to be related to the precision with which (a) the equations of motion can be integrated and (b) the "A" matrix in the Newton-Raphson coefficient modification equations can be inverted. It is highly desirable that the efficacy of doubling the number of decimal digits employed in these calculations be investigated. Currently 16 decimal digits are the maximum which can be used at the local computing facility.

Despite the fact that some success was achieved in improving the self-compatibility of the flight data this is really no substitute for flight data which is inherently more self-consistent. Accordingly, it would be desirable to try the entire procedure with data whose internal consistency is known to be superior to that used here.

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2. Smetana, F. O.; Summey, D. C.; and Johnson, W. D.: "Point and Path Performance of Light Aircraft". NASA CR-2272. 1973.

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APPENDICES

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APPENDIX A

FLIGHT DATA REDUCTION PROGRAM # 1

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User Instructions — FDRI

The program is written in FORTRAN IV and is designed to execute in double precision on an IBM 370/165 computer with an average execution time of 8 minutes 12 seconds for each maneuver data set. Execution requires approximately 724,000 bytes of core storage. The program is intended to handle data from only one flight during a given run. It is divided into two sections. The first section

(a) adjusts the input data, if desired, for an assumed phase shift,
(b) converts time, weight, pitch angle, pitch rate, airspeed, static pressure, angle of attack, total temperature, longitudinal acceleration, vertical acceleration, and elevator or stabilator deflection to compatible computational units,
(c) calculates the lag corrections to the static and dynamic pressures,
(d) applies the position-error correction ratio $\Delta p/q_c'$,
(e) applies the acceleration-dependent corrections to the static pressure,
(f) converts total temperature to static temperature, static pressure to density, density to altitude, and indicated airspeed to true airspeed,
(g) corrects the pitch angle indication for a known initial bias,
(h) corrects the angle-of-attack indication for the instrument location, and
(i) calibrates the angle-of-attack indication for a known or assumed bias and gain.

The second section

(a) performs Fourier-series analysis and filtering on the weight, pitch angle, pitch rate, airspeed, density, angle of attack, static temperature, longitudinal acceleration, altitude, vertical acceleration, and elevator or stabilator time histories,
(b) integrates the pitch rate indication to obtain the pitch angle indication,
(c) calculates
    (1) the acceleration from the airspeed,
    (2) the angle-of-attack rate-of-change from the Fourier-series-and-filter modification of the angle of attack or from the differentiation of a cubic-spline fit of the input angles of attack,
    (3) the density from altitude,
    (4) the altitude's rate of change and acceleration from the Fourier-series-and-filter modification of the altitude or from the differentiations of a cubic-spline fit of the "input" altitude time history,
    (5) the compatible angle-of-attack values from other time histories,

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(6) the compatible altitude and its rate-of-change values from the integration of the flight-path rate of change, and
(7) the inertial-compatible airspeed,

(d) performs a minimization technique with or without a priori values to make the data more consistent,
(e) plots the time histories,
(f) writes the results in English or SI units, and
(g) produces punched output for the FLIGHT DATA REDUCTION #2 program.

The program requires the specification of the following input:

FDR1 Section 1

CARD 1:

(a) The number of maneuvers NSETS in a single flight to be analyzed: NSETS is a right-adjusted integer number less than or equal to 10 and occupying columns 1-5. If NSETS is not an integer number between 0 and 10, the program will terminate permaturely.
(b) The desired type of output units METRIC for all data sets (maneuvers):
If METRIC = 0, the output will be in English units. If METRIC = 1, the output will be in SI units. METRIC is a right-adjusted integer number occupying columns 6-10. The specification of METRIC only affects the output listings. The punched output is in English units.

CARD 2:

The weight-time-history code ICODE for each of the NSETS maneuvers: If ICODE = 0, a continuous weight time history is produced from the first or preceding weight time history, assuming no elapsed time between the maneuvers. If ICODE = 1, a continuous weight time history is produced from the first or preceding weight time history with elapsed time considered between the maneuvers. The weight-time-history codes for the NSETS maneuvers are right-adjusted integer numbers with each maneuver's ICODE occupying 5 columns. (The ICODE parameter is used in conjunction with the ELAP parameter below.)

CARD 3:

(a) The maximum number of minimization-improvement iterations NUMBER to be used for the maneuver:
NUMBER is a right-adjusted integer number less than or equal to 10 and occupying columns 1-5. If NUMBER is less than zero, NUMBER will be set to zero. If NUMBER is greater than 10, logic errors will result beyond 10 iterations.

(b) The elapsed time ELAP to the maneuver in seconds:
For the first maneuver, ELAP should be the elapsed time from takeoff or engine-start to the beginning of the first maneuver. For the successive maneuvers, ELAP should be the elapsed time from the end of the previous maneuver to the beginning of the next maneuver. ELAP may be set equal to zero for any of the successive maneuvers. ELAP is a floating-point number occupying columns 6-15. (The ELAP parameter is used in conjunction with the ICODE parameter above.)

(c) The data set file number JFILE:
JFILE is a right-adjusted integer number occupying columns 16-20 and specifying that the data is to be read from cards, magnetic tape, disk, etc. The user must supply the suitable job control cards for the tape and/or disk reads. The JFILE parameter controls only the reading of CARDS (12 + MPTS + 1), ...,(12 + MPTS + 2K). All other data is expected to be in card form.

(d) The variable location numbers IVL(I), I = 1-9:
The variable location number "names" the variable occupying a particular data field on the records containing the time histories. IVL(I) are right-adjusted integer numbers each occupying 5 columns beginning at column 21. The program assumes that for each recorded time point there are 10 variables: time, pitch angle, pitch rate, airspeed, static pressure, angle of attack, stagnation temperature, longitudinal acceleration, vertical acceleration, and elevator or stabilator deflection. The program also assumes that "time" will always occupy the first data field. For the variables in the second through the tenth data fields, the following IVL's must correspond to the variable name:

Variable Name	IVL
Pitch angle	2
Pitch rate	3
Airspeed	4
Static pressure	5
Angle of attack	6
Stagnation temperature	7
Longitudinal acceleration	8
Vertical acceleration	10
Elevator (Stabilator) deflection	11

For example: If the time history variables were ordered as "time", "longitudinal acceleration", "pitch angle", "airspeed", "pitch rate", "static pressure", "angle of attack", "vertical acceleration", "stagnation temperature", and "elevator deflection", the IVL's would correspondingly be IVL(1)=8, IVL(2)=2, IVL(3)=4, IVL(4)=3, IVL(5)=5, IVL(6)=6, IVL(7)=10, IVL(8)=7, and IVL(9)=11.

CARD 4:

The 80 characters of the array TITLE which are used as a header for identifying the output:

Since the program allows more than one flight maneuver to be analyzed in a given run, TITLE is used as a control variable to end execution. Termination of execution is achieved by following the last maneuver's data set to be analyzed by a title card having only the word END in the first three columns.

CARD 5:

(a) The Fourier-series filter-cutoff harmonic NCH(1) for the lag corrections in the airspeed's static pressure system,

(b) The Fourier-series filter-cutoff harmonic NCH(2) for the lag corrections in the altitude's static pressure system,

(c) The Fourier-series filter-cutoff harmonic NCH(3) for the lag corrections in the altitude's and airspeed's stagnation pressure system,

(d) The Fourier-series filter-cutoff harmonic NCH(4) for the lag corrections in the stagnation temperature system:

NCH(1), NCH(2), NCH(3), and NCH(4) must be right-adjusted integer numbers greater than 0 but less than 66. Each NCH(I) occupies 5 columns with NCH(1) beginning at column 1.

(e) The lag time interval XLM(1)* in seconds for the stagnation pressure system,

(f) The lag time interval XLM(2)* in seconds for the altitude's static pressure system,

(g) The lag time interval XLM(3)* in seconds for the airspeed's static pressure system,

(h) The lag time constant TAU(1)* in seconds for the stagnation pressure system,

(i) The lag time constant TAU(2)* in seconds for the altitude's static pressure system,

(j) The lag time constant TAU(3)* in seconds for the airspeed's static pressure system,

XLM(1), XLM(2), XLM(3), TAU(1), TAU(2), and TAU(3) are floating-point numbers each occupying 10 columns beginning at column 21.

CARD 6:

(a) The assumed number of data points NSPTS to be indicative of a required phase shift:

If NSPTS is less than zero, NSPTS will be set to its absolute value. The value of (NSPTS x sampling rate) should not exceed

---

*These parameters are defined in the discussion accompanying equations.

unity; however, this suggestion is not mandatory. NSPTS is a right-adjusted integer number less than the total number of data points occupying columns 1-5.

(b) The pitch angle linear drift DRIFT:
DRIFT is used by the equation:

$$(\text{pitch angle})_{new} = (\text{pitch angle})_{old} + \text{DRIFT} \times (\text{point number/total number of points})$$

If DRIFT = 0.0, the application is bypassed. DRIFT is a floating-point number in radians/second occupying 15 columns beginning at column 6.

CARD 7:

(a) The phase shift parameter LSP(1) for pitch angle,
(b) the phase shift parameter LSP(2) for pitch rate,
(c) the phase shift parameter LSP(3) for airspeed,
(d) the phase shift parameter LSP(4) for static pressure,
(e) the phase shift parameter LSP(5) for angle of attack,
(f) the phase shift parameter LSP(6) for stagnation temperature,
(g) the phase shift parameter LSP(7) for longitudinal acceleration,
(h) the phase shift parameter LSP(8) for vertical acceleration, and
(i) the phase shift parameter LSP(9) for the elevator or stabilator deflection:
If LSP(I) = 0, no phase shift is desired on variable "I" (or variable "I" was recorded by commutation). If LSP(I) = 1, a phase shift is desired on variable "I" (or variable "I" was recorded by frequency modulation). LSP(I) are right-adjusted integer numbers each occupying 5 columns beginning at column 1.

CARD 8:

(a) The aircraft's wing area S in square feet,
(b) the aircraft's gross takeoff weight GWT in pounds force,
(c) the fuel consumption rate FCR1 in pounds force per second from takeoff or engine-start to the first maneuver,
(d) the fuel consumption rate FCR2 in pounds force per second during the maneuvers,
(e) the angle-of-attack-instrument location XACG in feet from the aircraft's center of gravity,
(f) the pitch-angle-instrument-bias correction PCCG in radians,
(g) the calibration factor CALP1 to the angle of attack, and
(h) the calibration term CALP2 in radians to the angle of attack:
It should be noted that the program assumes FCR1 for the fuel consumption rate between maneuvers where the elapsed time ELAP is nonzero. XACG is a positive quantity if the instrument is ahead of the cg and negative if it is behind

the cg. S, GWT, FCR1, FCR2, XACG, PCCG, CALP1, and CALP2 are floating-point numbers each occupying 10 columns beginning at column 1.

CARDS 9, 10, 11:

(a) The conversion factor CF(1) of time to seconds,
(b) the conversion factor CF(2) of weight to pounds force,
(c) the conversion factor CF(3) of pitch angle to radians,
(d) the conversion factor CF(4) of pitch rate to radian per second,
(e) the conversion factor CF(5) of airspeed to feet per second,
(f) the conversion factor CF(6) of static pressure to pounds force per square foot,
(g) the conversion factor CF(7) of angle of attack to radians,
(h) the conversion factor CF(8) of stagnation temperature in the equation $T(°R)=CF(8)\times T(°X)+CF(9)$ for degrees Rankine,
(i) the conversion term CF(9) of stagnation temperature in the equation $T(°R)=CF(8)\times T(°X)+CF(9)$ for degrees Rankine,
(j) the conversion factor CF(10) of longitudinal acceleration to feet per squared second,
(k) the conversion factor CF(11) of vertical acceleration to feet per squared second, and
(l) the conversion factor CF(12) of elevator or stabilator deflection to radians:

If CF(8) = 0.0, CF(8) is set equal to 1.0. CF(1) through CF(12) are double-precision floating-point numbers occupying 20 card-columns each. CF(1) through CF(4) are contained on the ninth input-data card beginning with column 1, CF(5) through CF(8) are contained on the tenth input-data card, and CF(9) through CF(12) are contained on the eleventh input-data card beginning with column 1.

CARD 12:

The number of points MPTS on the (ratio-of-the-pressure-difference-to-the-dynamic-pressure versus the-indicated-airspeed) curve for the position-error pressure corrections:

MPTS must be greater than zero and no larger than 20. MPTS is a right-adjusted integer number occupying columns 1-2.

CARD 13,...,(12 + MPTS):

The measured values of the ratio of the pressure difference to the dynamic pressure DPQCP, and the measured values of the indicated airspeed VE in feet per second:

It is suggested that the values of DPQCP and VE span a sufficiently large region to include the input data's speed range. DPQCP and VE are floating-point numbers occupying columns 1-20 and columns 21-40, respectively, for each of the MPTS cards.

CARDS (12 + MPTS + 1), ..., (12 + MPTS + 2K):

The time histories of time TIME(K), pitch angle D(K,IVL=2), pitch rate D(K,IVL=3), airspeed D(K,IVL=4), static pressure D(K,IVL=5), angle of attack D(K,IVL=6), stagnation temperature D(K,IVL=7), longitudinal acceleration D(K,IVL=8), vertical acceleration D(K,IVL=10), and elevator or stabilator deflection D(K,IVL=11) for K=1 through K=450(maximum). It should be noted that IVL parameters in D(K,IVL) correspond to the variable location numbers IVL(I) described on page 211. The duration of a maneuver is determined either by a maximum count of 450 data points and the perception of two(2) user-supplied blank or zero cards within the next 1000 counts or by the perception of two(2) user-supplied blank or zero cards.* TIME(K) and the D(K,IVL)'s are double-precision floating-point numbers. Two(2) cards describe a single data point with TIME(K) always occupying columns 1-15 on the first card. Each card contains five variables each occupying 15 columns beginning at column 1.

FDR1 Section 2

CARD (12 + MPTS + 2K + 1):

(a) The Fourier-series analysis code IFS(1) for weight,
(b) the Fourier-series analysis code IFS(2) for pitch angle,
(c) the Fourier-series analysis code IFS(3) for pitch rate,
(d) the Fourier-series analysis code IFS(4) for airspeed,
(e) the Fourier-series analysis code IFS(5) for density,
(f) the Fourier-series analysis code IFS(6) for angle of attack,
(g) the Fourier-series analysis code IFS(7) for static temperature,
(h) the Fourier-series analysis code IFS(8) for acceleration,
(i) the Fourier-series analysis code IFS(9) for altitude,
(j) the Fourier-series analysis code IFS(10) for vertical acceleration, and
(k) the Fourier-series analysis code IFS(11) for elevator or stabilator deflection:

If IFS(I) = 0, analysis is performed on the "I"th time history.
IF IFS(I) = 1, no analysis is performed on the "I"th time history.
IFS(I) are right-adjusted integer numbers each occupying 1 column beginning at column 1.

*In general, data sets will consist of more than 450 points. In order that the parameters of successive data sets are properly entered, all "extra" time-history data of the present maneuver must be ignored. The extra 1000-count specification "implies" that within 1000 data points beyond the maximum 450 data points the two(2) user-supplied blank or zero cards will be encountered.

CARD (12 + MPTS + 2K + 2):

(a) The acceleration-determination code IPRC(1):
If IPRC(1) = 0, the acceleration is calculated by the differentiation of the airspeed time history. If IPRC(1) = 1, the longitudinal acceleration is transformed into the rate-of-change of airspeed by the kinematic relationship between the aircraft's body axis and its flight path.

(b) The degree of computation on the longitudinal acceleration IPRC(2):
If IPRC(2) = 0, the longitudinal acceleration is transformed into the rate-of-change of airspeed by the kinematic relationship between the aircraft's body axis and its flight path and is smoothed by Fourier series and filtering. If IPRC(2) = 1, the longitudinal acceleration is only transformed into the rate-of-change of airspeed by the kinematic relationship between the aircraft's body axis and its flight path. If IPRC(2) = 2, the input values of longitudinal acceleration are retained. The following chart should be consulted in specifying IFS(4), IPRC(1), and IPRC(2) so that the program produces desired results:

Parameter Combinations	Results
IFS(4)=0, IPRC(1)=0, IPRC(2)=0	Result #1
IFS(4)=0, IPRC(1)=0, IPRC(2)=1	Result #1
IFS(4)=0, IPRC(1)=0, IPRC(2)=2	Result #1
IFS(4)=0, IPRC(1)=1, IPRC(2)=0	Result #2
IFS(4)=0, IPRC(1)=1, IPRC(2)=1	Result #3
IFS(4)=0, IPRC(1)=1, IPRC(2)=2	Illegal combination
IFS(4)=1, IPRC(1)=0, IPRC(2)=0	Result #4
IFS(4)=1, IPRC(1)=0, IPRC(2)=1	Result #4
IFS(4)=1, IPRC(1)=0, IPRC(2)=2	Illegal combination
IFS(4)=1, IPRC(1)=1, IPRC(2)=0	Result #4
IFS(4)=1, IPRC(1)=1, IPRC(2)=1	Result #4
IFS(4)=1, IPRC(1)=1, IPRC(2)=2	Illegal combination

Result #1: Airspeed will be the smoothed input airspeed. Acceleration will be the differentiation of the smoothed airspeed.

Result #2: Airspeed will be the smoothed input airspeed. Acceleration will be the Fourier-series-smoothed rate-of-change of airspeed transformation of the longitudinal acceleration.

Result #3: Airspeed will be the smoothed input airspeed. Acceleration will be the unsmoothed rate-of-change of airspeed transformation of the longitudinal acceleration.

Result #4: Airspeed will be the input airspeed. Acceleration will be the Fourier-series-smoothed rate-of-change of airspeed transformation of longitudinal acceleration.

(c) The method of angle-of-attack rate computation IPRC(3):
If IPRC(3) = 0, the angle-of-attack rate will be calculated by the differentiation of the angle-of-attack's Fourier series. If IPRC(3) = 1, the angle-of-attack rate will be the differentiation of a cubic-spline fit of the angle of attack. It should be noted that if IFS(6) = 1 and IPRC(3) = 0, the program will set IPRC(3) = 1. IPRC(3) is a right-adjusted integer number occupying 1 column beginning at column 3.

(d) The overall Fourier-series analysis code IPRC(4):
If IPRC(4) = 0, Fourier-series analysis will be performed on the time histories whose IFS(I) are zero. If IPRC(4) = 1, no Fourier-series analysis will be performed even if IFS(I) = 0. The specification of IPRC(4) = 1 provides a means to analyze "raw" data. IPRC(4) is a right-adjusted integer number occupying one column beginning at column 4.

(e) The overall plotting code IPRC(5):
If IPRC(5) = 0, plots are requested. If IPRC(5) = 1, no plots are requested. IPRC(5) is a right-adjusted integer number occupying one column beginning at column 5.

(f) The punch code IPRC(6):
If IPRC(6) = 0, punched output is requested. If IPRC(6) = 1, no punched output is requested. IPRC(6) is a right-adjusted integer number occupying one column beginning at column 6.

(g) The pitch-angle determination code IPRC(7):
If IPRC(7) = 0, the pitch-angle time history will be the "modified" input pitch-angle time history. If IPRC(7) = 1, the pitch-angle time history will be the integrated pitch-rate time history. IPRC(7) is a right-adjusted integer number occupying one column beginning at column 7.

(h) The compatibility check IPRC(8):
If IPRC(8) = 0, the compatibility check is bypassed. If IPRC(8) = 1, an angle-of-attack time history will be computed to be compatible with other time histories. If IPRC(8) = 2, an altitude time history will be computed to be pneumatically compatible with other time histories. It should be noted that the compatible altitude time history will exist only on the altitude-time-history plot whereas the compatible angle-of-attack time history will replace the existing angle-of-attack time history. Generally, IPRC(8) should be zero. IPRC(8) is a right-adjusted integer number occupying one column beginning at column 8.

(i) The calculation code of the inertial-compatible altitude and airspeed IPRC(9):
If IPRC(9) = 0, the calculation of the inertial-compatible altitude and airspeed will be bypassed. If IPRC(9) = 1, the inertial-compatible altitude and airspeed will be computed. (If only the inertial-compatible airspeed is desired, see the discussion of FAC1 and FAC2 below.)

(j) The distance XAX in feet of the longitudinal accelerometer from the aircraft's cg:
XAX is a positive quantity if the accelerometer is ahead of the cg and a negative quantity if the accelerometer is behind the cg. Parameter XAX is a double-precision floating-point number occupying 15 columns beginning at column 11.

(k) The fraction of the pneumatic-compatible altitude FAC1 and the fraction of the inertial-compatible altitude FAC2:
The sum of FAC1 and FAC2 should be equal to 1.0; that is, FAC1 + FAC2 = 1.0. If only the inertial-compatible airspeed is desired, the user must specify IPRC(9) = 1, FAC1 = 1.0, and FAC2 = 0.0. Parameters FAC1 and FAC2 are double-precision floating-point numbers each occupying 15 columns beginning at column 26.

(l) The data sampling rate DSPS per second:
Parameter DSPS is a double-precision floating-point number occupying 15 columns beginning at column 56.

CARD (12 + MPTS + 2K + 3):

(a) The plot code IP(1) for weight,
(b) the plot code IP(2) for pitch angle,
(c) the plot code IP(3) for pitch rate,
(d) the plot code IP(4) for airspeed,
(e) the plot code IP(5) for density,
(f) the plot code IP(6) for angle of attack,
(g) the plot code IP(7) for static temperature,
(h) the plot code IP(8) for acceleration,
(i) the plot code IP(9) for angle-of-attack rate,
(j) the plot code IP(10) for altitude,
(k) the plot code IP(11) for altitude rate of change,
(l) the plot code IP(12) for altitude acceleration,
(m) the plot code IP(13) for vertical acceleration, and
(n) the plot code IP(14) for the elevator or stabilator deflection.
If IP(I)=0, a plot is produced for the "I"th time history.
If IP(I)=1, no plot is produced for the "I"th time history.
IP(I) are right-adjusted integer numbers each occupying one column beginning at column 1.

CARD (12 + MPTS + 2K + 4):

(a) The filter cutoff harmonic NC(1) for weight,
(b) the filter cutoff harmonic NC(2) for pitch angle,
(c) the filter cutoff harmonic NC(3) for pitch rate,
(d) the filter cutoff harmonic NC(4) for airspeed,
(e) the filter cutoff harmonic NC(5) for density,
(f) the filter cutoff harmonic NC(6) for angle of attack,
(g) the filter cutoff harmonic NC(7) for static temperature,
(h) the filter cutoff harmonic NC(8) for acceleration,
(i) the filter cutoff harmonic NC(9) for altitude,

(j) the filter cutoff harmonic NC(10) for vertical, and
(k) the filter cutoff harmonic NC(11) for the elevator or stabilator deflection.

All NC(I) are right-adjusted integer numbers each occupying 5 columns beginning at column 1. It is mandatory that $0 < NC(I) < 66$.

CARDS (12 + MPTS + 2K + 5), ..., (12 + MPTS + 2K + 10):

(a) The a priori value AP(1) in feet per second squared and its weight W(1) for the first linear acceleration dependency,
(b) the a priori value AP(2) in feet per second squared and its weight W(2) for the second linear acceleration dependency,
(c) the a priori value AP(3) in feet per second squared and its weight W(3) for the third linear acceleration dependency,
(d) the a priori value AP(4) in radians and its weight W(4) for the pitch angle bias,
(e) the a priori value AP(5) and its weight W(5) for the phase shift, and
(f) the a priori value AP(6) in radians and its weight W(6) for the flight-path-angle bias:

AP(I) and W(I) are double-precision floating-point numbers each occupying 20 columns beginning at column 1. Each of the six(6) input cards contains the AP(I) and W(I) that correspond to the dependency or bias under consideration.

CARDS (12 + MPTS + 2K + 11), ..., (12 + MPTS + 2K + 10 + NUMBER!/(NUMBER-1)!):

(a) The code IR(1) for the calculation of the first linear acceleration dependency,
(b) the code IR(2) for the calculation of the second linear acceleration dependency,
(c) the code IR(3) for the calculation of the third linear acceleration dependency,
(d) the code IR(4) for the calculation of the pitch-angle bias,
(e) the code IR(5) for the calculation of the phase shift, and
(f) the code IR(6) for the calculation of the flight-path-angle bias.

If IR(I) = 0, the calculation for the "I"th variable is excluded. If IR(I) = 1, the calculation for the "I"th variable is included. The calculation of at least one variable, preferably two, must be included. Failure to specify at least one variable will terminate the program prematurely. Parameters IR(I) are right-adjusted integer numbers each occupying one column beginning at column 1. It is necessary to provide [(NUMBER!)/(NUMBER-1)!] input cards containing the IR(I) codes.

For a given run consisting of one or more data sets (maneuvers), cards 1 and 2 need to be specified only once. Cards 3 through (12 + MPTS + 2K + 10 + NUMBER!/(NUMBER-1)!) need to be specified for each maneuver.

Program Listing – FDRI

```
C     PROGRAM:  FLIGHT DATA REDUCTION #1 (FDR1)  F.O. SMETANA/ S.B. FOX
C
C                    **********************************
C                    *                                *
C                    *  DATA REDUCTION SECTION NO. 1  *
C                    *                                *
C                    **********************************
C
C
C     GIVEN VALUES OF THE AIRCRAFT CHARACTERISTICS AND THE AIRCRAFT'S
C     FLIGHT TIME-HISTORIES OF PITCH ANGLE, PITCH RATE, AIRSPEED, STATIC
C     PRESSURE, ANGLE OF ATTACK, TOTAL TEMPERATURE, LONGITUDINAL ACCEL-
C     ERATION, VERTICAL ACCELERATION, AND ELEVATOR (OR STABILATOR)
C     DEFLECTION, THIS SECTION PERFORMS THE FOLLOWING:
C
C        1) ADJUSTS DATA, IF DESIRED, FOR AN ASSUMED PHASE SHIFT
C
C        2) CONVERTS TIME TO SECONDS
C
C        3) COMPUTES TOTAL MANEUVER EXECUTION TIME
C
C        4) COMPUTES AIRCRAFT'S WEIGHT TIME HISTORY
C
C        5) CONVERTS WEIGHT TO POUNDS FORCE
C
C        6) CONVERTS PITCH ANGLE TO RADIANS
C
C        7) CONVERTS PITCH RATE TO RADIANS PER SECOND
C
C        8) CONVERTS AIRSPEED TO FEET PER SECOND
C
C        9) CONVERTS STATIC PRESSURE TO POUNDS FORCE PER SQUARE FOOT
C
C       10) CONVERTS ANGLE OF ATTACK TO RADIANS
C
C       11) CONVERTS TOTAL TEMPERATURE TO DEGREES RANKINE
C
C       12) CONVERTS LONGITUDINAL ACCELERATION TO FEET PER
C           SECOND SQUARED
C
C       13) CONVERTS VERTICAL ACCELERATION TO FEET PER SECOND SQUARED
C
C       14) CONVERTS ELEVATOR (OR STABILATOR) DEFLECTION TO RADIANS
C
C       15) CALCULATES LAG CORRECTIONS TO STATIC PRESSURE AND DYNAMIC
C           PRESSURE
C
C       16) CALCULATES POSITION ERROR CORRECTION RATIO DP/QC'
C
C       17) CALCULATES ACCELERATION-DEPENDENT CORRECTIONS TO STATIC
C           PRESSURE
C
C       18) CONVERTS TOTAL TEMPERATURE TO STATIC TEMPERATURE
C
C       19) CONVERTS STATIC PRESSURE TO DENSITY
C
C       20) CONVERTS DENSITY TO ALTITUDE
C
C       21) CONVERTS INDICATED AIRSPEED TO TRUE AIRSPEED
C
C       22) CORRECTS PITCH ANGLE INDICATION FOR KNOWN INITIAL BIAS AND
C           ANGLE OF ATTACK INDICATION FOR INSTRUMENT LOCATION
C
C       23) CALIBRATES ANGLE OF ATTACK INDICATION
C
C       24) PREPARES DATA FOR DATA REDUCTION SECTION NO. 2
C
C
C     THE FOLLOWING COMMENT CARDS DESCRIBE THE NECESSARY INPUT FOR
C     DATA REDUCTION SECTION NO.1.  FOR A MORE PRECISE DESCRIPTION,
C     CONSULT THE USERS INSTRUCTIONS.
C
C INPUT *** CARD 1
C
C         NSETS   ->  NUMBER OF DATA SETS TO BE ANALYZED
C                     ( -1 < NSETS < 11 )
C
C         METRIC  ->  TYPE OF OUTPUT UNITS
C                     METRIC=0 :  ENGLISH UNITS
C                     METRIC=1 :  SI UNITS
C
C
C INPUT *** CARD 2
C
C         ICODE   ->  ICODE=0 :  CONTINUOUS WEIGHT TIME HISTORY
C                                (CONTINUOUS FROM FIRST OR PRECEDING
C                                WEIGHT TIME HISTORY WITH NO ELAPSED
C                                TIME CONSIDERATIONS BETWEEN MANEUVERS)
C
C                     ICODE=1 :  DISCONTINUOUS WEIGHT TIME HISTORY
C                                (CONTINUOUS FROM FIRST OR PRECEDING
C                                WEIGHT TIME HISTORY WITH ELAPSED TIME
C                                CONSIDERATIONS BETWEEN MANEUVERS)
C
C
C INPUT *** CARD 3
C
C         NUMBER -> MAXIMUM NUMBER OF IMPROVEMENT ITERATIONS
C
C         ELAP   -> ELAPSED TIME TO MANEUVER IN SECONDS
C
C         JFILE  -> DATA SET FILE NUMBER
C
C         IVL(1) -> LOCATION NUMBER OF VARIABLE IN 2ND DATA FIELD
C         IVL(2) -> LOCATION NUMBER OF VARIABLE IN 3RD DATA FIELD
C         IVL(3) -> LOCATION NUMBER OF VARIABLE IN 4TH DATA FIELD
C         IVL(4) -> LOCATION NUMBER OF VARIABLE IN 5TH DATA FIELD
C         IVL(5) -> LOCATION NUMBER OF VARIABLE IN 6TH DATA FIELD
C         IVL(6) -> LOCATION NUMBER OF VARIABLE IN 7TH DATA FIELD
C         IVL(7) -> LOCATION NUMBER OF VARIABLE IN 8TH DATA FIELD
C         IVL(8) -> LOCATION NUMBER OF VARIABLE IN 9TH DATA FIELD
C         IVL(9) -> LOCATION NUMBER OF VARIABLE IN 10TH DATA FIELD
C
C
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C
C INPUT *** *CARD* 4     (FROM DATA SET JFILE)                                  ML  121
C                                                                               ML  122
C         TITLE  -> TITLE CARD FOR MANEUVER                                     ML  123
C                                                                               ML  124
C                                                                               ML  125
C                                                                               ML  126
C INPUT *** CARD 5                                                              ML  127
C                                                                               ML  128
C                                                                               ML  129
C         NCH(1) ->  FOURIER SERIES CUTOFF HARMONIC FOR AIRSPEED'S              ML  130
C                    STATIC PRESSURE MEASUREMENTS   0<NCH(1)<66                 ML  131
C                                                                               ML  132
C         NCH(2) ->  FOURIER SERIES CUTOFF HARMONIC FOR ALTITUDE'S              ML  133
C                    STATIC PRESSURE MEASUREMENTS   0<NCH(2)<66                 ML  134
C                                                                               ML  135
C         NCH(3) ->  FOURIER SERIES CUTOFF HARMONIC FOR AIRSPEED'S AND          ML  136
C                    ALTITUDE'S STAGNATION PRESSURE   0<NCH(3)<66               ML  137
C                                                                               ML  138
C         NCH(4) ->  FOURIER SERIES CUTOFF HARMONIC FOR STAGNATION              ML  139
C                    TEMPERATURE MEASUREMENTS   0<NCH(4)<66                     ML  140
C                                                                               ML  141
C         XLN(1) ->  LAG TIME INTERVAL FOR STAGNATION PRESSURE SYSTEMS          ML  142
C                    IN SECONDS                                                 ML  143
C                                                                               ML  144
C         XLN(2) ->  LAG TIME INTERVAL FOR ALTITUDE'S STATIC PRESSURE           ML  145
C                    SYSTEMS IN SECONDS                                         ML  146
C                                                                               ML  147
C         XLN(3) ->  LAG TIME INTERVAL FOR AIRSPEED'S STATIC PRESSURE           ML  148
C                    SYSTEMS IN SECONDS                                         ML  149
C                                                                               ML  150
C         TAU(1) ->  LAG TIME CONSTANT FOR STAGNATION PRESSURE SYSTEMS          ML  151
C                    IN SECONDS                                                 ML  152
C                                                                               ML  153
C         TAU(2) ->  LAG TIME CONSTANT FOR ALTITUDE'S STATIC PRESSURE           ML  154
C                    SYSTEMS IN SECONDS                                         ML  155
C                                                                               ML  156
C         TAU(3) ->  LAG TIME CONSTANT FOR AIRSPEED'S STATIC PRESSURE           ML  157
C                    SYSTEMS IN SECONDS                                         ML  158
C                                                                               ML  159
C                                                                               ML  160
C                                                                               ML  161
C INPUT *** CARD 6                                                              ML  162
C                                                                               ML  163
C         NSPTS  ->  ASSUMED NUMBER OF DATA POINTS TO BE INDICATIVE OF          ML  164
C                    A REQUIRED PHASE SHIFT                                     ML  165
C                                                                               ML  166
C         DRIFT  ->  PITCH ANGLE DRIFT (RADIAN/SEC) USED BY:                    ML  167
C                    PITCH ANGLE(NEW)=PITCH ANGLE(OLD)+DRIFT*(POINT             ML  168
C                                    NUMBER)/(TOTAL NUMBER OF POINTS)           ML  169
C                                                                               ML  170
C                                                                               ML  171
C INPUT *** CARD 7                                                              ML  172
C                                                                               ML  173
C                                                                               ML  174
C         LSP(1) ->  PHASE SHIFT PARAMETER FOR PITCH ANGLE                      ML  175
C                    LSP(1)=0 :  NO SHIFT (COMMUTATION)                         ML  176
C                    LSP(1)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  177
C                                                                               ML  178
C         LSP(2) ->  PHASE SHIFT PARAMETER FOR PITCH RATE                       ML  179
C                    LSP(2)=0 :  NO SHIFT (COMMUTATION)                         ML  180
C                    LSP(2)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  181
C                                                                               ML  182
C         LSP(3) ->  PHASE SHIFT PARAMETER FOR AIRSPEED                         ML  183
C                    LSP(3)=0 :  NO SHIFT (COMMUTATION)                         ML  184
C                    LSP(3)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  185
C                                                                               ML  186
C         LSP(4) ->  PHASE SHIFT PARAMETER FOR STATIC PRESSURE                  ML  187
C                    LSP(4)=0 :  NO SHIFT (COMMUTATION)                         ML  188
C                    LSP(4)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  189
C                                                                               ML  190
C         LSP(5) ->  PHASE SHIFT PARAMETER FOR ANGLE OF ATTACK                  ML  191
C                    LSP(5)=0 :  NO SHIFT (COMMUTATION)                         ML  192
C                    LSP(5)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  193
C                                                                               ML  194
C         LSP(6) ->  PHASE SHIFT PARAMETER FOR STAGNATION TEMPERATURE           ML  195
C                    LSP(6)=0 :  NO SHIFT (COMMUTATION)                         ML  196
C                    LSP(6)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  197
C                                                                               ML  198
C         LSP(7) ->  PHASE SHIFT PARAMETER FOR LONGITUDINAL ACCELERATION        ML  199
C                    LSP(7)=0 :  NO SHIFT (COMMUTATION)                         ML  200
C                    LSP(7)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  201
C                                                                               ML  202
C         LSP(8) ->  PHASE SHIFT PARAMETER FOR VERTICAL ACCELERATION            ML  203
C                    LSP(8)=0 :  NO SHIFT (COMMUTATION)                         ML  204
C                    LSP(8)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  205
C                                                                               ML  206
C         LSP(9) ->  PHASE SHIFT PARAMETER FOR ELEVATOR DEFLECTION              ML  207
C                    LSP(9)=0 :  NO SHIFT (COMMUTATION)                         ML  208
C                    LSP(9)=1 :  SHIFT (FREQUENCY MODULATION)                   ML  209
C                                                                               ML  210
C                                                                               ML  211
C                                                                               ML  212
C INPUT *** CARD 8                                                              ML  213
C                                                                               ML  214
C         S      ->  WING AREA IN SQUARE FEET                                   ML  215
C                                                                               ML  216
C         GWT    ->  GROSS TAKEOFF WEIGHT IN POUNDS FORCE                       ML  217
C                                                                               ML  218
C         FCN1   ->  FUEL CONSUMPTION RATE IN POUNDS FORCE PER SECOND           ML  219
C                    FROM TAKEOFF TO FIRST MANEUVER                             ML  220
C                                                                               ML  221
C         FCN2   ->  FUEL CONSUMPTION RATE IN POUNDS FORCE PER SECOND           ML  222
C                    DURING MANEUVERS                                           ML  223
C                                                                               ML  224
C         XACG   ->  ANGLE-OF-ATTACK INSTRUMENT LOCATION FROM CENTER OF         ML  225
C                    GRAVITY (POSITIVE IF XACG AHEAD CG, NEGATIVE IF            ML  226
C                    XACG BEHIND CG) IN FEET                                    ML  227
C                                                                               ML  228
C         ECCG   ->  ARCUN PITCH-ANGLE INSTRUMENT BIAS CORRECTION IN            ML  229
C                    RADIANS                                                    ML  230
C                                                                               ML  231
C         CALE1  ->  CALIBRATION FACTOR TO ANGLE OF ATTACK                      ML  232
C                                                                               ML  233
C         CALE2  ->  CALIBRATION TERM TO ANGLE OF ATTACK IN RADIANS             ML  234
C                                                                               ML  235
C                                                                               ML  236
C                                                                               ML  237
C INPUT *** CARDS 9,10,11    CONVERSION FACTORS OR TERMS                        ML  238
C                                                                               ML  239
C         CF(1)  ->  TIME TO SECONDS                                            ML  240
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C                                                                       NL  241
C       CF(2)  ->  WEIGHT TO POUNDS FORCE                               NL  242
C                                                                       NL  243
C       CF(3)  ->  PITCH ANGLE TO RADIANS                               NL  244
C                                                                       NL  245
C       CF(4)  ->  PITCH RATE TO RADIANS PER SECOND                     NL  246
C                                                                       NL  247
C       CF(5)  ->  AIRSPEED TO FEET PER SECOND                          NL  248
C                                                                       NL  249
C       CF(6)  ->  STATIC PRESSURE TO POUNDS FORCE PER SQUARE FOOT      NL  250
C                                                                       NL  251
C       CF(7)  ->  ANGLE OF ATTACK TO RADIANS                           NL  252
C                                                                       NL  253
C       CF(8)  ->  TEMPERATURE FACTOR FOR DEGREES RANKINE               NL  254
C                    T = CF(8)*TEMP + CF(9)                             NL  255
C       CF(9)  ->  TEMPERATURE TERM FOR DEGREES RANKINE                 NL  256
C                    T = CF(8)*TEMP + CF(9)                             NL  257
C       CF(10) ->  LONGITUDINAL ACCELERATION TO FEET PER                NL  258
C                  SQUARED SECOND                                       NL  259
C                                                                       NL  260
C       CF(11) ->  VERTICAL ACCELERATION TO FEET PER SQUARED SECONDS    NL  261
C                                                                       NL  262
C       CF(12) ->  ELEVATOR DEFLECTION TO RADIANS                       NL  263
C                                                                       NL  264
C                                                                       NL  265
C                                                                       NL  266
C INPUT *** CARD 12                                                     NL  267
C                                                                       NL  268
C       MPTS   ->  NUMBER OF POINTS ON DPQCP VS. VE CURVE <21           NL  269
C                                                                       NL  270
C                                                                       NL  271
C                                                                       NL  272
C INPUT *** CARDS 13,....,(12+MPTS)                                     NL  273
C                                                                       NL  274
C       DPQCP  ->  MEASURED POSITION ERROR CORRECTION RATIO             NL  275
C                                                                       NL  276
C       VE     ->  MEASURED VALUES OF INDICATED AIRSPEED IN FEET PER    NL  277
C                  SECOND                                               NL  278
C                                                                       NL  279
C                                                                       NL  280
C INPUT *** 'CARDS' (12+MPTS+1),....,(12+MPTS+K)    (FROM DATA SET JFILE) NL  281
C                                                                       NL  282
C       IDENTIFICATION OF NECESSARY INPUT TIME HISTORIES                NL  283
C                                                                       NL  284
C            TIME(I) ->  TIME                                           NL  285
C            D(I,2)  ->  PITCH ANGLE                                    NL  286
C            D(I,3)  ->  PITCH RATE                                     NL  287
C            D(I,4)  ->  AIRSPEED                                       NL  288
C            D(I,5)  ->  STATIC PRESSURE                                NL  289
C            D(I,6)  ->  ANGLE OF ATTACK                                NL  290
C            D(I,7)  ->  STAGNATION TEMPERATURE                         NL  291
C            D(I,8)  ->  LONGITUDINAL ACCELERATION                      NL  292
C            D(I,10) ->  VERTICAL ACCELERATION                          NL  293
C            D(I,11) ->  ELEVATOR DEFLECTION                            NL  294
C                                                                       NL  295
C                                                                       NL  296
C                                                                       NL  297
C                                                                       NL  298
C                  **********************************                   NL  299
C                                                                       NL  300
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C                                                                       NL  301
C                  *                                *                   NL  302
C                  *  DATA REDUCTION SECTION NO. 2  *                   NL  303
C                  *                                *                   NL  304
C                  **********************************                   NL  305
C                                                                       NL  306
C                                                                       NL  307
C  THE FOLLOWING PROGRAM CAPABILITIES ARE OPTIONAL.  THE USER MUST      NL  308
C  SPECIFY THE DESIRED OPTIONS.  THE USER SHOULD CONSULT THE USERS      NL  309
C  INSTRUCTIONS ('FDR1',SECTION 2) FOR 'ILLEGAL' OPTION COMBINATIONS.   NL  310
C  GIVEN VALUES OF THE AIRCRAFT CHARACTERISTICS AND TIME HISTORIES OF   NL  311
C  WEIGHT, PITCH ANGLE, PITCH RATE, AIRSPEED, DENSITY, ANGLE-OF-        NL  312
C  ATTACK, STATIC TEMPERATURE, LONGITUDINAL ACCELERATION, ALTITUDE,     NL  313
C  VERTICAL ACCELERATION, AND ELEVATOR (OR STABILATOR) DEFLECTION,      NL  314
C  THIS SECTION PERFORMS THE FOLLOWING:                                 NL  315
C                                                                       NL  316
C                                                                       NL  317
C     1) PERFORMS FOURIER ANALYSIS AND FILTERING ON WEIGHT TIME         NL  318
C        HISTORY                                                        NL  319
C                                                                       NL  320
C     2) PERFORMS FOURIER ANALYSIS AND FILTERING ON PITCH ANGLE TIME    NL  321
C        HISTORY                                                        NL  322
C                                                                       NL  323
C     3) PERFORMS FOURIER ANALYSIS AND FILTERING ON PITCH RATE TIME     NL  324
C        HISTORY                                                        NL  325
C                                                                       NL  326
C     4) INTEGRATES PITCH RATE TO OBTAIN PITCH ANGLE, IF DESIRED        NL  327
C                                                                       NL  328
C     5) PERFORMS FOURIER ANALYSIS AND FILTERING ON AIRSPEED TIME       NL  329
C        HISTORY                                                        NL  330
C                                                                       NL  331
C     6) CALCULATES ACCELERATION FROM AIRSPEED                          NL  332
C                                                                       NL  333
C     7) PERFORMS FOURIER ANALYSIS AND FILTERING ON DENSITY TIME        NL  334
C        HISTORY                                                        NL  335
C                                                                       NL  336
C     8) PERFORMS FOURIER ANALYSIS AND FILTERING ON ANGLE-OF-ATTACK     NL  337
C        TIME HISTORY                                                   NL  338
C                                                                       NL  339
C     9) CALCULATES ANGLE-OF-ATTACK RATE FROM THE FOURIER-FILTER        NL  340
C        MODIFICATION OF ANGLE OF ATTACK OR FROM DIFFERENTIATION OF     NL  341
C        SPLINED-INPUT ANGLE OF ATTACK                                  NL  342
C                                                                       NL  343
C    10) PERFORMS FOURIER ANALYSIS AND FILTERING OF STATIC              NL  344
C        TEMPERATURE TIME HISTORY                                       NL  345
C                                                                       NL  346
C    11) CONVERTS LONGITUDINAL ACCELERATION INTO ACCELERATION           NL  347
C        COMPATIBLE WITH AIRSPEED                                       NL  348
C                                                                       NL  349
C    12) PERFORMS FOURIER ANALYSIS AND FILTERING OF LONGITUDINAL        NL  350
C        ACCELERATION TIME HISTORY                                      NL  351
C                                                                       NL  352
C    13) PERFORMS FOURIER ANALYSIS AND FILTERING OF ALTITUDE TIME       NL  353
C        HISTORY                                                        NL  354
C                                                                       NL  355
C    14) CALCULATES DENSITY FROM ALTITUDE                               NL  356
C                                                                       NL  357
C    15) CALCULATES ALTITUDE RATE OF CHANGE AND ACCELERATION FROM       NL  358
C        DIFFERENTIATIONS OF THE FOURIER-FILTER MODIFICATION OF         NL  359
C        ALTITUDE OR SPLINED-INPUT ALTITUDE                             NL  360
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C
C       16) CALCULATES COMPATIBLE ANGLE-OF-ATTACK VALUES FROM OTHER          NL  361
C           TIME HISTORIES                                                   NL  362
C                                                                            NL  363
C       17) CALCULATES COMPATIBLE ALTITUDE AND ALTITUDE RATE FROM            NL  364
C           INTEGRAL OF DERIVATIVE OF FLIGHT-PATH ANGLE                      NL  365
C                                                                            NL  366
C       18) PERFORMS FOURIER ANALYSIS AND FILTERING ON VERTICAL              NL  367
C           ACCELERATION TIME HISTORY                                        NL  368
C                                                                            NL  369
C       19) PERFORMS FOURIER ANALYSIS AND FILTERING ON ELEVATOR (OR          NL  370
C           STABILATOR) DEFLECTION TIME HISTORY                              NL  371
C                                                                            NL  372
C       20) PERFORMS MINIMIZATION WITH OR WITHOUT A PRIORI VALUES FOR        NL  373
C           DATA COMPATIBILITY                                               NL  374
C                                                                            NL  375
C       21) PLOTS TIME HISTORIES                                             NL  376
C                                                                            NL  377
C       22) WRITES RESULTS IN ENGLISH OR SI UNITS                            NL  378
C                                                                            NL  379
C       23) PUNCHES CARDS FOR USE IN PROGRAM 'FDR2'                          NL  380
C                                                                            NL  381
C                                                                            NL  382
C                                                                            NL  383
C     THE FOLLOWING COMMENT CARDS DESCRIBE THE NECESSARY INPUT FOR           NL  384
C     DATA REDUCTION SECTION NO.2.  FOR A MORE PRECISE DESCRIPTION,          NL  385
C     CONSULT THE USERS INSTRUCTIONS.                                        NL  386
C                                                                            NL  387
C INPUT *** CARD (12*NPTS+K+1)                                               NL  388
C                                                                            NL  389
C       IFS(1) ->  FOURIER ANALYSIS ON WEIGHT TIME HISTORY                   NL  390
C                  IFS(1)=0  -> YES                                          NL  391
C                  IFS(1)=1  -> NO                                           NL  392
C                                                                            NL  393
C       IFS(2) ->  FOURIER ANALYSIS ON PITCH ANGLE TIME HISTORY              NL  394
C                  IFS(2)=0  -> YES                                          NL  395
C                  IFS(2)=1  -> NO                                           NL  396
C                                                                            NL  397
C       IFS(3) ->  FOURIER ANALYSIS ON PITCH RATE TIME HISTORY               NL  398
C                  IFS(3)=0  -> YES                                          NL  399
C                  IFS(3)=1  -> NO                                           NL  400
C                                                                            NL  401
C       IFS(4) ->  FOURIER ANALYSIS ON AIRSPEED TIME HISTORY                 NL  402
C                  IFS(4)=0  -> YES                                          NL  403
C                  IFS(4)=1  -> NO                                           NL  404
C                                                                            NL  405
C       IFS(5) ->  FOURIER ANALYSIS ON DENSITY TIME HISTORY                  NL  406
C                  IFS(5)=0  -> YES                                          NL  407
C                  IFS(5)=1  -> NO                                           NL  408
C                                                                            NL  409
C       IFS(6) ->  FOURIER ANALYSIS ON ANGLE OF ATTACK TIME HISTORY          NL  410
C                  IFS(6)=0  -> YES                                          NL  411
C                  IFS(6)=1  -> NO                                           NL  412
C                                                                            NL  413
C       IFS(7) ->  FOURIER ANALYSIS ON STATIC TEMPERATURE TIME HISTORY       NL  414
C                  IFS(7)=0  -> YES                                          NL  415
C                  IFS(7)=1  -> NO                                           NL  416
C                                                                            NL  417
C                                                                            NL  418
C       IFS(8) ->  FOURIER ANALYSIS ON 'ACCELERATION' TIME HISTORY           NL  419
C                  IFS(8)=0  -> YES                                          NL  420
C                  IFS(8)=1  -> NO                                           NL  421
C                                                                            NL  422
C       IFS(9) ->  FOURIER ANALYSIS ON ALTITUDE TIME HISTORY                 NL  423
C                  IFS(9)=0  -> YES                                          NL  424
C                  IFS(9)=1  -> NO                                           NL  425
C                                                                            NL  426
C      IFS(10) ->  FOURIER ANALYSIS ON VERTICAL ACCELERATION HISTORY         NL  427
C                  IFS(10)=0 -> YES                                          NL  428
C                  IFS(10)=1 -> NO                                           NL  429
C                                                                            NL  430
C      IFS(11) ->  FOURIER ANALYSIS ON (ELEVATOR/STABILATOR) HISTORY         NL  431
C                  IFS(11)=0 -> YES                                          NL  432
C                  IFS(11)=1 -> NO                                           NL  433
C                                                                            NL  434
C                                                                            NL  435
C                                                                            NL  436
C INPUT *** CARD (12*NPTS+K+2)                                               NL  437
C                                                                            NL  438
C      IPRC(1) ->  METHOD OF ACCELERATION DETERMINATION                      NL  439
C                  IPRC(1)=0 -> DERIVATIVE OF AIRSPEED TIME HISTORY          NL  440
C                  IPRC(1)=1 -> CONVERTED LONGITUDINAL ACCELERATION          NL  441
C                                                                            NL  442
C      IPRC(2) ->  DEGREE OF COMPUTATION ON LONGITUDINAL ACCELERATION        NL  443
C                  IPRC(2)=0 -> LONGITUDINAL ACCELERATION CONVERTED TO       NL  444
C                               RATE-OF-CHANGE OF AIRSPEED BY TRANS-         NL  445
C                               FORMATION AND SMOOTHED BY FILTERING          NL  446
C                  IPRC(2)=1 -> LONGITUDINAL ACCELERATION CONVERTED TO       NL  447
C                               RATE-OF-CHANGE OF AIRSPEED BY TRANS-         NL  448
C                               FORMATION                                    NL  449
C                  IPRC(2)>1 -> ORIGINAL LONGITUDINAL ACCELERATION           NL  450
C                                                                            NL  451
C      IPRC(3) ->  METHOD OF ANGLE-OF-ATTACK RATE COMPUTATION                NL  452
C                  IPRC(3)=0 -> DERIVATIVE OF ANGLE-OF-ATTACK HISTORY        NL  453
C                  IPRC(3)=1 -> DERIVATIVE OF SPLINED ANGLE OF ATTACK        NL  454
C                                                                            NL  455
C      IPRC(4) ->  OVERALL FOURIER ANALYSIS CODE                             NL  456
C                  IPRC(4)=0 -> REQUEST FOURIER ANALYSIS                     NL  457
C                  IPRC(4)=1 -> DECLINE FOURIER ANALYSIS                     NL  458
C                                                                            NL  459
C      IPRC(5) ->  OVERALL PLOTTING CODE                                     NL  460
C                  IPRC(5)=0 -> REQUEST PLOTS                                NL  461
C                  IPRC(5)=1 -> DECLINE PLOTS                                NL  462
C                                                                            NL  463
C      IPRC(6) ->  PUNCH CODE                                                NL  464
C                  IPRC(6)=0 -> REQUEST PUNCHED CARDS                        NL  465
C                  IPRC(6)=1 -> DECLINE PUNCHED CARDS                        NL  466
C                                                                            NL  467
C      IPRC(7) ->  METHOD OF PITCH ANGLE DETERMINATION                       NL  468
C                  IPRC(7)=0 -> ORIGINAL PITCH-ANGLE TIME HISTORY            NL  469
C                  IPRC(7)=1 -> INTEGRATION OF PITCH-RATE TIME HISTORY       NL  470
C                                                                            NL  471
C      IPRC(8) ->  COMPATIBILITY CHECK                                       NL  472
C                  IPRC(8)=0 -> BYPASS COMPATIBILITY CHECK                   NL  473
C                  IPRC(8)=1 -> COMPUTE COMPATIBLE ANGLE OF ATTACK           NL  474
C                  IPRC(8)=2 -> COMPUTE COMPATIBLE ALTITUDE                  NL  475
C                                                                            NL  476
C      IPRC(9) ->  CALCULATION OF INERTIAL-COMPATIBLE ALTITUDE               NL  477
C                  IPRC(9)=0 -> BYPASS ANALYSIS                              NL  478
C                  IPRC(9)=1 -> PERFORM ANALYSIS                             NL  479
C                                                                            NL  480
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ORIGINAL PAGE IS
OF POOR QUALITY

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C
C       RAI     ->  LOCATION OF ACCELEROMETER FROM CG IN FEET                  RL  481
C                   (POSITIVE IF AHEAD, NEGATIVE IF BEHIND)                    RL  482
C                                                                              RL  483
C       FAC1    ->  FRACTION OF PNEUMATIC-COMPATIBLE ALTITUDE SUCH THAT        RL  484
C                   FAC1+FAC2=1.0                                              RL  485
C       FAC2    ->  FRACTION OF INERTIAL-COMPATIBLE ALTITUDE SUCH THAT         RL  486
C                   FAC1+FAC2=1.0                                              RL  487
C                                                                              RL  488
C       ESPS    ->  DATA SAMPLING RATE (PER SECOND)                            RL  489
C                                                                              RL  490
C                                                                              RL  491
C INPUT *** CARD (12+NPTS+K+3)                                                 RL  492
C                                                                              RL  493
C                                                                              RL  494
C       IP(1)   ->  PLOT CODE FOR WEIGHT TIME HISTORY                          RL  495
C                   IP(1)=0  -> REQUESTED                                      RL  496
C                   IP(1)=1  -> NOT REQUESTED                                  RL  497
C                                                                              RL  498
C       IP(2)   ->  PLOT CODE FOR PITCH ANGLE TIME HISTORY                     RL  499
C                   IP(2)=0  -> REQUESTED                                      RL  500
C                   IP(2)=1  -> NOT REQUESTED                                  RL  501
C                                                                              RL  502
C       IP(3)   ->  PLOT CODE FOR PITCH RATE TIME HISTORY                      RL  503
C                   IP(3)=0  -> REQUESTED                                      RL  504
C                   IP(3)=1  -> NOT REQUESTED                                  RL  505
C                                                                              RL  506
C       IP(4)   ->  PLOT CODE FOR AIRSPEED TIME HISTORY                        RL  507
C                   IP(4)=0  -> REQUESTED                                      RL  508
C                   IP(4)=1  -> NOT REQUESTED                                  RL  509
C                                                                              RL  510
C       IP(5)   ->  PLOT CODE FOR DENSITY TIME HISTORY                         RL  511
C                   IP(5)=0  -> REQUESTED                                      RL  512
C                   IP(5)=1  -> NOT REQUESTED                                  RL  513
C                                                                              RL  514
C       IP(6)   ->  PLOT CODE FOR ANGLE OF ATTACK TIME HISTORY                 RL  515
C                   IP(6)=0  -> REQUESTED                                      RL  516
C                   IP(6)=1  -> NOT REQUESTED                                  RL  517
C                                                                              RL  518
C       IP(7)   ->  PLOT CODE FOR STATIC TEMPERATURE TIME HISTORY              RL  519
C                   IP(7)=0  -> REQUESTED                                      RL  520
C                   IP(7)=1  -> NOT REQUESTED                                  RL  521
C                                                                              RL  522
C       IP(8)   ->  PLOT CODE FOR ACCELERATION TIME HISTORY                    RL  523
C                   IP(8)=0  -> REQUESTED                                      RL  524
C                   IP(8)=1  -> NOT REQUESTED                                  RL  525
C                                                                              RL  526
C       IP(9)   ->  PLOT CODE FOR ANGLE-OF-ATTACK RATE TIME HISTORY            RL  527
C                   IP(9)=0  -> REQUESTED                                      RL  528
C                   IP(9)=1  -> NOT REQUESTED                                  RL  529
C                                                                              RL  530
C       IP(10)  ->  PLOT CODE FOR ALTITUDE TIME HISTORY                        RL  531
C                   IP(10)=0 -> REQUESTED                                      RL  532
C                   IP(10)=1 -> NOT REQUESTED                                  RL  533
C                                                                              RL  534
C       IP(11)  ->  PLOT CODE FOR ALTITUDE RATE TIME HISTORY                   RL  535
C                   IP(11)=0 -> REQUESTED                                      RL  536
C                   IP(11)=1 -> NOT REQUESTED                                  RL  537
C                                                                              RL  538
C       IP(12)  ->  PLOT CODE FOR ALTITUDE ACCELERATION TIME HISTORY           RL  539
C                   IP(12)=0 -> REQUESTED                                      RL  540
C                   IP(12)=1 -> NOT REQUESTED                                  RL  541
C                                                                              RL  542
C       IP(13)  ->  PLOT CODE FOR VERTICAL ACCELERATION TIME HISTORY           RL  543
C                   IP(13)=0 -> REQUESTED                                      RL  544
C                   IP(13)=1 -> NOT REQUESTED                                  RL  545
C                                                                              RL  546
C       IP(14)  ->  PLOT CODE FOR (ELEVATOR/STABILATOR) TIME HISTORY           RL  547
C                   IP(14)=0 -> REQUESTED                                      RL  548
C                   IP(14)=1 -> NOT REQUESTED                                  RL  549
C                                                                              RL  550
C                                                                              RL  551
C                                                                              RL  552
C INPUT *** CARD (12+NPTS+K+4)                                                 RL  553
C                                                                              RL  554
C                                                                              RL  555
C       NC(1)   ->  FILTER CUTOFF HARMONIC FOR WEIGHT                          RL  556
C                   ( 0 < NC(1) < 66 )                                         RL  557
C                                                                              RL  558
C       NC(2)   ->  FILTER CUTOFF HARMONIC FOR PITCH ANGLE                     RL  559
C                   ( 0 < NC(2) < 66 )                                         RL  560
C                                                                              RL  561
C       NC(3)   ->  FILTER CUTOFF HARMONIC FOR PITCH RATE                      RL  562
C                   ( 0 < NC(3) < 66 )                                         RL  563
C                                                                              RL  564
C       NC(4)   ->  FILTER CUTOFF HARMONIC FOR AIRSPEED                        RL  565
C                   ( 0 < NC(4) < 66 )                                         RL  566
C                                                                              RL  567
C       NC(5)   ->  FILTER CUTOFF HARMONIC FOR DENSITY                         RL  568
C                   ( 0 < NC(5) < 66 )                                         RL  569
C                                                                              RL  570
C       NC(6)   ->  FILTER CUTOFF HARMONIC FOR ANGLE OF ATTACK                 RL  571
C                   ( 0 < NC(6) < 66 )                                         RL  572
C                                                                              RL  573
C       NC(7)   ->  FILTER CUTOFF HARMONIC FOR STATIC TEMPERATURE              RL  574
C                   ( 0 < NC(7) < 66 )                                         RL  575
C                                                                              RL  576
C       NC(8)   ->  FILTER CUTOFF HARMONIC FOR ACCELERATION                    RL  577
C                   ( 0 < NC(8) < 66 )                                         RL  578
C                                                                              RL  579
C       NC(9)   ->  FILTER CUTOFF HARMONIC FOR ALTITUDE                        RL  580
C                   ( 0 < NC(9) < 66 )                                         RL  581
C                                                                              RL  582
C       NC(10)  ->  FILTER CUTOFF HARMONIC FOR VERTICAL ACCELERATION           RL  583
C                   ( 0 < NC(10) < 66 )                                        RL  584
C                                                                              RL  585
C       NC(11)  ->  FILTER CUTOFF HARMONIC FOR ELEVATOR/STABILATOR             RL  586
C                   DEFLECTION      (0 < NC(11) < 66)                          RL  587
C                                                                              RL  588
C                                                                              RL  589
C INPUT *** CARDS (12+NPTS+K+5), ... ,(12+NPTS+K+10)                           RL  590
C                                                                              RL  591
C       AP(1), W(1)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE FIRST           RL  592
C                        LINEAR ACCELERATION DEPENDENCY                        RL  593
C                                                                              RL  594
C       AP(2), W(2)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE SECOND          RL  595
C                        LINEAR ACCELERATION DEPENDENCY                        RL  596
C                                                                              RL  597
C       AP(3), W(3)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE THIRD           RL  598
C                        LINEAR ACCELERATION DEPENDENCY                        RL  599
C                                                                              RL  600
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C          AP(4), W(4)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE PITCH      NL  601
C                           ANGLE BIAS                                        NL  602
C                                                                             NL  603
C          AP(5), W(5)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE PHASE       NL  604
C                           SHIFT                                             NL  605
C                                                                             NL  606
C          AP(6), W(6)  ->  A PRIORI VALUE AND ITS WEIGHT FOR THE FLIGHT      NL  607
C                           PATH ANGLE BIAS                                   NL  608
C                                                                             NL  609
C                                                                             NL  610
C INPUT *** CARDS (12+NPTS+K+11), ...,(12+NPTS+K+10+NUMBER1/(NUMBER-1) 1)     NL  611
C                                                                             NL  612
C  FOR CARD:                                                                  NL  613
C                                                                             NL  614
C          IB(1)  ->  CODE FOR THE CALCULATION OF THE FIRST LINEAR            NL  615
C                     ACCELERATION DEPENDENCY                                 NL  616
C                     IB(1)=0  -> EXCLUDE                                     NL  617
C                     IB(1)=1  -> INCLUDE                                     NL  618
C                                                                             NL  619
C          IB(2)  ->  CODE FOR THE CALCULATION OF THE SECOND LINEAR           NL  620
C                     ACCELERATION DEPENDENCY                                 NL  621
C                     IB(2)=0  -> EXCLUDE                                     NL  622
C                     IB(2)=1  -> INCLUDE                                     NL  623
C                                                                             NL  624
C                                                                             NL  625
C          IB(3)  ->  CODE FOR THE CALCULATION OF THE THIRD LINEAR            NL  626
C                     ACCELERATION DEPENDENCY                                 NL  627
C                     IB(3)=0  -> EXCLUDE                                     NL  628
C                     IB(3)=1  -> INCLUDE                                     NL  629
C                                                                             NL  630
C          IB(4)  ->  CODE FOR THE CALCULATION OF THE PITCH ANGLE BIAS        NL  631
C                     IB(4)=0  -> EXCLUDE                                     NL  632
C                     IB(4)=1  -> INCLUDE                                     NL  633
C                                                                             NL  634
C          IB(5)  ->  CODE FOR THE CALCULATION OF THE PHASE SHIFT             NL  635
C                     IB(5)=0  -> EXCLUDE                                     NL  636
C                     IB(5)=1  -> INCLUDE                                     NL  637
C                                                                             NL  638
C          IB(6)  ->  CODE FOR THE CALCULATION OF THE FLIGHT PATH ANGLE       NL  639
C                     BIAS                                                    NL  640
C                     IB(6)=0  -> EXCLUDE                                     NL  641
C                     IB(6)=1  -> INCLUDE                                     NL  642
C                                                                             NL  643
C                                                                             NL  644
      IMPLICIT REAL*8(A-H,O-Z)                                                NL  645
      EXTERNAL PHIDER                                                         NL  646
      DIMENSION WHEN(10),DPQCP(20),WE(20),AA(4,20),ICODE(11),XH(450,1),C      NL  647
     1H(450,4),ISP(9),NCH(4),XLB(3),TAU(3),CF(12),PA(450),SUPC(10),NUPC(      NL  648
     110),IVL(9)                                                              NL  649
      COMMON TITLE(20),D(450,11),TIME(450),A(100),W(100),P1(450),P2(450)      NL  650
     1,P3(450),ASPD(450),P(450),PD(450),PS(450),PSD(450),TT,RNO,PI,G,JPL      NL  651
     10T,METRIC,JREAD,JWRITE,JPUNCH,IERR                                      NL  652
      COMMON /TEMP1/ST(450,8),PAR(6),PSL,TSL,IPAR                             NL  653
      DATA XEND/4HEND /                                                       NL  654
C                                                                             NL  655
C***  SPECIFY CARRIAGE CONTROL FOR INSTALLATION                               NL  656
      JREAD=1                                                                 NL  657
      JWRITE=3                                                                NL  658
      JPUNCH=2                                                                NL  659
                                                                              NL  660
C***  INITIALIZE PARAMETERS                                                   NL  661
      G=32.2D0                                                                NL  662
      GAMMA=1.4D0                                                             NL  663
      R=1716.161200                                                           NL  664
      RHC=0.0C2378D0                                                          NL  665
      TSL=518.7200                                                            NL  666
      PSL=14.7D0*144.0D0                                                      NL  667
      PI=3.1415926535898793D0                                                 NL  668
      JPLOT=0                                                                 NL  669
      EJ=1                                                                    NL  670
C                                                                             NL  671
C                                                                             NL  672
      READ (JREAD,1) NSETS,METRIC                                             NL  673
    1 FORMAT (2I5)                                                            NL  674
C                                                                             NL  675
      IF (NSETS.LE.0.OR.NSETS.GT.10) GO TO 121                                NL  676
C                                                                             NL  677
C                                                                             NL  678
      READ (JREAD,2) (ICODE(I),I=1,NSETS)                                     NL  679
    2 FORMAT (10I5)                                                           NL  680
C                                                                             NL  681
      ICODE(NSETS+1)=0                                                        NL  682
C                                                                             NL  683
C                                                                             NL  684
    3 READ (JREAD,4) NUMBER,KLAP,JFILE,(IVL(I),I=1,9)                         NL  685
    4 FORMAT (I5,F10.0,10I5)                                                  NL  686
C                                                                             NL  687
C                                                                             NL  688
    5 READ (JFILE,6) (TITLE(I),I=1,20)                                        NL  689
    6 FORMAT (20A4)                                                           NL  690
C                                                                             NL  691
C***  CHECK FOR EXECUTION TERMINATION                                         NL  692
      IF (TITLE(1).EQ.XEND) GO TO 123                                         NL  693
C***  INITIALIZE ERROR CODES                                                  NL  694
      IERR=0                                                                  NL  695
      IHC=0                                                                   NL  696
C                                                                             NL  697
C                                                                             NL  698
      READ (JREAD,7) NCH(1),NCH(2),NCH(3),NCH(4),XLB(1),XLB(2),XLB(3),TA      NL  699
     1U(1),TAU(2),TAU(3)                                                      NL  700
    7 FORMAT (4I5,6F10.0)                                                     NL  701
C                                                                             NL  702
C                                                                             NL  703
      READ (JREAD,8) NSPTS,DRIFT                                              NL  704
    8 FORMAT (I5,F15.0)                                                       NL  705
C                                                                             NL  706
C***  FORCE NSPTS TO BE POSITIVE                                              NL  707
      NSPTS=IABS(NSPTS)                                                       NL  708
C                                                                             NL  709
C                                                                             NL  710
      READ (JREAD,9) (ISP(I),I=1,9)                                           NL  711
    9 FORMAT (9I5)                                                            NL  712
C                                                                             NL  713
C                                                                             NL  714
      READ (JREAD,10) S,GWT,PCR1,PCR2,HACG,PCCG,CALP1,CALP2                   NL  715
   10 FORMAT (8F10.0)                                                         NL  716
C                                                                             NL  717
C                                                                             NL  718
      READ (JREAD,11) CF(1),CF(2),CF(3),CF(4),CF(5),CF(6),CF(7),CF(8),CF      NL  719
     1(9),CF(10),CF(11),CF(12)                                                NL  720
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   11 FORMAT (4D20.0/4D20.0/4D20.0)                                      NL  721
C                                                                        NL  722
C                                                                        NL  723
      READ (JREAD,12) NPTS                                               NL  724
   12 FORMAT (I2)                                                        NL  725
C                                                                        NL  726
C                                                                        NL  727
      READ (JREAD,13) (VE(I),DPQCCP(I),I=1,NPTS)                         NL  728
   13 FORMAT (2F20.0)                                                    NL  729
C                                                                        NL  730
      K=1                                                                NL  731
C                                                                        NL  732
C                                                                        NL  733
   14 READ (JFILE,15) TIME(K),D(K,IVL(1)),D(K,IVL(2)),D(K,IVL(3)),D(K,IV  NL  734
     1E(4)),D(K,IVL(5)),D(K,IVL(6)),D(K,IVL(7)),D(K,IVL(8)),D(K,IVL(9))  NL  735
   15 FORMAT (5D15.8/5D15.8)                                             NL  736
C***  CHECK FOR DATA SET END OF FILE                                     NL  737
      IF (K.GE.450) GO TO 21                                             NL  738
      IF (D(K,5).EQ.0.0D0) GO TO 20                                      NL  739
      IF (K.GE.2) GO TO 16                                               NL  740
      GO TO 17                                                           NL  741
C***  CHECK FOR EQUAL OR DECREASING TIME                                 NL  742
   16 IF (TIME(K).LE.TIME(K-1)) GO TO 18                                 NL  743
   17 K=K+1                                                              NL  744
      GO TO 14                                                           NL  745
   18 WRITE (JWRITE,19) K                                                NL  746
   19 FORMAT (1H1,///,11X,54H*** EQUAL OR DECREASING TIME ENCOUNTERED ON  NL  747
     1 DATA CARD(,I3,42H).  PROCEEDING WITH NEXT DATA SET, IF ANY.)      NL  748
      IERR=1                                                             NL  749
   20 K=K-1                                                              NL  750
      IF (IERR.NE.0) GO TO 22                                            NL  751
      GO TO 24                                                           NL  752
C***  SAFETY CHECK FOR ARRAY OVERFLOW                                    NL  753
   21 IF (D(K,5).EQ.0.0D0) GO TO 20                                      NL  754
      K=K-1                                                              NL  755
   22 JK=1000                                                            NL  756
C***  THIS READ STATEMENT READS CARDS REMAINING AFTER MAXIMUM CARD       NL  757
C***  COUNT INTO DUMMY VARIABLES                                         NL  758
      DO 23 JP=1,JK                                                      NL  759
      READ (JFILE,15) D1,D2,D3,D4,D5,D6,D7,D8,D9,D10                     NL  760
      IF (D5.EQ.0.0D0) GO TO 24                                          NL  761
   23 CONTINUE                                                           NL  762
C***  CHECK ON TOTAL NUMBER OF POINTS                                    NL  763
   24 IF (K.LT.13) GO TO 25                                              NL  764
      IF (IERR.NE.0) GO TO 117                                           NL  765
      GO TO 27                                                           NL  766
   25 WRITE (JWRITE,26)                                                  NL  767
   26 FORMAT (1X,///,10X,79HNUMBER OF DATA POINTS IS LESS THAN 13 .  PRO  NL  768
     1CEEDING WITH NEXT DATA SET, IF ANY.)                               NL  769
      IERR=1                                                             NL  770
C***  CHECK FOR A NEW DATA SET                                           NL  771
      GO TO 117                                                          NL  772
C***  CHECK FOR INCONSISTENCIES IN FOURIER SERIES SPECIFICATIONS         NL  773
   27 IF ((NCH(1).LE.0.OR.NCH(2).LE.0).OR.(NCH(3).LE.0.OR.NCH(4).LE.0))I  NL  774
     1NC=1                                                               NL  775
      IF (INC.NE.0) WRITE (JWRITE,28)                                    NL  776
   28 FORMAT (1H1,///,1X,'NCH(1), NCH(2), NCH(3), AND/OR NCH(4) HAVE(HAS  NL  777
     1) BEEN SPECIFIED INCORRECTLY AS BEING LESS THAN OR EQUAL TO ZERO.'  NL  778
     1)                                                                  NL  779
      IF (INC.NE.0)IERR=1                                                NL  780
      IF (IERR.NE.0) GO TO 117                                           NL  781
C***  COMPUTE TOTAL TIME AND TIME POINTS IN CORRECT UNITS                NL  782
      IF (CF(1).EQ.0.0D0) GO TO 29                                       NL  783
      TT=(TIME(K)-TIME(1))*CF(1)                                         NL  784
      TPT1=TIME(1)                                                       NL  785
      GO TO 30                                                           NL  786
   29 TT=TIME(K)-TIME(1)                                                 NL  787
      TPT1=TIME(1)                                                       NL  788
   30 DO 32 I=1,K                                                        NL  789
      IF (CF(1).EQ.0.0D0) GO TO 31                                       NL  790
      TIME(I)=(TIME(I)-TPT1)*CF(1)                                       NL  791
      GO TO 32                                                           NL  792
   31 TIME(I)=TIME(I)-TPT1                                               NL  793
   32 CONTINUE                                                           NL  794
C***  WRITE TITLE, WING AREA, REFERENCE DENSITY, G, AND TOTAL TEST TIME  NL  795
      WRITE (JWRITE,33) (TITLE(I),I=1,20)                                NL  796
   33 FORMAT (1H1,////,23X,84('*')/,23X,'*',82X,'*'/,23X,'*',20A4,2X,'*  NL  797
     1*'/,23X,'*',82X,'*'/,23X,84('*'))                                  NL  798
C***  WRITE INPUT PARAMETERS                                             NL  799
      WRITE (JWRITE,34) NSETS                                            NL  800
   34 FORMAT (1X,///,29X,71('-')/,29X,'|',69X,'|',/,29X,'|',39X,6HNSETS  NL  801
     1=,I3,21X,'|',/,29X,'|',4X,26HSECTION 1 INPUT PARAMETERS,23X,5HICOD  NL  802
     1E,11X,'|')                                                         NL  803
      WRITE (JWRITE,35) (ICCDE(I),I=1,NSETS)                             NL  804
   35 FORMAT (29X,'|',56X,I1,12X,'|')                                    NL  805
      WRITE (JWRITE,36)                                                  NL  806
   36 FORMAT (29X,'|',69X,'|')                                           NL  807
      WRITE (JWRITE,37) METRIC,XLN(1),FCB1,CF(1),NCH(1),XLN(2),FCB2,CF(2  NL  808
     1),NCH(2),XLN(3),XACG,CF(3),NCH(3),TAU(1),PCCG,CF(4),NCH(4),TAU(2),  NL  809
     1CALP1,CF(5),S,TAU(3),CALP2,CF(6),NPTS,GMT,NSPTS,CF(7),LSP(1),LSP(2  NL  810
     1),LSP(3),LSP(4),CF(8),LSP(5),LSP(6),LSP(7),LSP(8),CF(9),LSP(9),RHA  NL  811
     1P,DRIFT,CF(10),CF(11),CF(12)                                       NL  812
   37 FORMAT (29X,'|',3X,'METRIC= ',I3,2X,'XLN(1)= ',F7.4,2X,'FCB1= ',F9  NL  813
     1.6,2X,'CF(1)= ',D10.3,2X,'|',/,29X,'|',3X,'NCH(1)= ',I3,2X,'XLN(2)  NL  814
     1= ',F7.4,2X,'FCB2= ',F9.6,2X,'CF(2)= ',D10.3,2X,'|',/,29X,'|',3X,'  NL  815
     1NCH(2)= ',I3,2X,'XLN(3)= ',F7.4,2X,'XACG= ',F9.6,2X,'CF(3)= ',D10.  NL  816
     13,2X,'|',/,29X,'|',3X,'NCH(3)= ',I3,2X,'TAU(1)= ',F7.4,2X,'PCCG= '  NL  817
     1,F9.6,2X,'CF(4)= ',D10.3,2X,'|',/,29X,'|',3X,'NCH(4)= ',I3,2X,'TAU  NL  818
     1(2)= ',F7.4,2X,'CALP1= ',F8.4,2X,'CF(5)= ',D10.3,2X,'|',/,29X,'|',  NL  819
     13X,'S= ',F8.4,2X,'TAU(3)= ',F7.4,2X,'CALP2= ',F8.4,2X,'CF(6)= ',D1  NL  820
     10.3,2X,'|',/,29X,'|',3X,'NPTS= ',I3,4X,'GMT= ',F10.5,2X,'NSPTS= ',  NL  821
     1I3,7X,'CF(7)= ',D10.3,2X,'|',/,29X,'|',3X,'LSP(1)= ',I1,2X,'LSP(2)  NL  822
     1= ',I1,2X,'LSP(3)= ',I1,2X,'LSP(4)= ',I1,5X,'CF(8)= ',D10.3,2X,'|'  NL  823
     1,/,29X,'|',3X,'LSP(5)= ',I1,2X,'LSP(6)= ',I1,2X,'LSP(7)= ',I1,2X,'  NL  824
     1LSP(8)= ',I1,5X,'CF(9)= ',D10.3,2X,'|',/,29X,'|',3X,'LSP(9)= ',I1,  NL  825
     12X,'ELAP= ',F9.6,3X,'DRIFT= ',F9.2,2X,'CF(10)=',D10.3,2X,'|',/,29X  NL  826
     1,'|',50X,'CF(11)=',D10.3,2X,'|',/,29X,'|',50X,'CF(12)=',D10.3,2X,'  NL  827
     1|',/,29X,'|',69X,'|',//,29X,'|',20X,'VE',9X,'DPQCCP',33X,'|',/,29X,'  NL  828
     1|',69X,'|')                                                        NL  829
      WRITE (JWRITE,38) (VE(I),DPCCP(I),I=1,NPTS)                        NL  830
   38 FORMAT (29X,'|',17X,F9.4,3X,F9.6,31X,'|')                          NL  831
      WRITE (JWRITE,39)                                                  NL  832
   39 FORMAT (29X,'|',69('_'),'|')                                       NL  833
      IF (METRIC.NE.0) GO TO 41                                          NL  834
      WRITE (JWRITE,40) S,RHO,G,TT                                       NL  835
   40 FORMAT (1X,//,38X,51('*'),/,38X,'*',49X,'*',/,38X,'*',13H WING ARE  NL  836
     1A = ,F10.5,6H FT**2,20X,'*',/,38X,'*',21H REFERENCE DENSITY = ,F10  NL  837
     1.8,11H SLUG/FT**3,7X,'*',/,38X,'*',31H ACCELERATION DUE TO GRAVITY  NL  838
     1 = ,F7.4,10H FT/SEC**2,1X,'*',/,38X,'*',19H TOTAL TEST TIME = ,F10  NL  839
     1.4,8H SECONDS,12X,'*',/,38X,'*',49X,'*',/,38X,51('*'))             NL  840
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      GO TO 43                                                          RL  841
   41 SIN=S*(0.3048D0)**2                                               RL  842
      RHOSE=RHO*515.3800                                                RL  843
      GIN=G*0.3048D0                                                    RL  844
      WRITE (JWRITE,42) SIN,RHOSE,GIN,TI                                RL  845
   42 FORMAT (1H,//,38X,51('*')/,38X,'*',49X,'*',/,38X,'*',133H WING ARE RL  846
     1A = ,F11.5,5H M**2,20X,'*'/,38X,'*',/,38X,'*',21H REFERENCE DENSITY RL  847
     1= ,F12.8H KG/M**3,8X,'*'/,38X,'*',/,38X,'*',31H ACCELERATION DUE TO RL  848
     1GRAVITY = ,F10.4,9H M/SEC**2,1X,'*'/,38X,'*',/,38X,'*',19H TOTAL TEST RL  849
     1TIME = ,F10.4,8H SECONDS,12X,'*'/,38X,'*',/,38X,'*',49X,'*'/,38X,51('*RL  850
C***  COMPUTE AIRCRAFT WEIGHT TIME HISTORY                              RL  851
   43 IF (ICODE(KJ).EQ.0) IGWT=1                                        RL  852
      IF (ICODE(KJ).NE.0) IGWT=0                                        RL  853
      IF (KJ.GT.1.AND.IGWT.EQ.1) GO TO 47                               RL  854
      IF (KJ.EQ.1) WMIN(KJ)=GWT-FCR1*ELAP                               RL  855
      IF (KJ.GT.1.AND.IGWT.EQ.0) GO TO 44                               RL  856
      GO TO 45                                                          RL  857
   44 WMIN(KJ)=WMIN(KJ-1)-FCR1*ELAP                                     RL  858
   45 DO 46 I=1,K                                                       RL  859
   46 D(I,1)=WMIN(KJ)-FCR2*TIME(I)                                      RL  860
      WMIN(KJ)=D(K,1)                                                   RL  861
      GO TO 48                                                          RL  862
   47 WMIN(KJ)=WMIN(KJ-1)                                               RL  863
      GO TO 45                                                          RL  864
C***  CONVERT FLIGHT PARAMETERS TO COMPATIBLE UNITS                     RL  865
   48 DO 58 I=1,K                                                       RL  866
      IF (CF(2).EQ.0.0D0) GO TO 49                                      RL  867
C***  CONVERT WEIGHT TO LBF                                            RL  868
      D(I,1)=D(I,1)*CF(2)                                               RL  869
   49 IF (CF(3).EQ.0.0D0) GO TO 50                                      RL  870
C***  CONVERT PITCH ANGLE TO RADIANS                                    RL  871
      D(I,2)=D(I,2)*CF(3)                                               RL  872
C***  APPLY PITCH ANGLE DRIFT IF SPECIFIED                             RL  873
      IF (DRIFT.NE.0) D(I,2)=D(I,2)+DRIFT*DFLOAT(I)/K                   RL  874
   50 IF (CF(4).EQ.0.0D0) GO TO 51                                      RL  875
C***  CONVERT PITCH RATE TO RADIANS/SEC                                 RL  876
      D(I,3)=D(I,3)*CF(4)                                               RL  877
   51 IF (CF(5).EQ.0.0D0) GO TO 52                                      RL  878
C***  CONVERT AIRSPEED TO FT/SEC                                       RL  879
      D(I,4)=D(I,4)*CF(5)                                               RL  880
   52 IF (CF(6).EQ.0.0D0) GO TO 53                                      RL  881
C***  CONVERT STATIC PRESSURE TO LBF/FT**2                             RL  882
      D(I,5)=D(I,5)*CF(6)                                               RL  883
   53 IF (CF(7).EQ.0.0D0) GO TO 54                                      RL  884
C***  CONVERT ANGLE OF ATTACK TO RADIANS                               RL  885
      D(I,6)=D(I,6)*CF(7)                                               RL  886
   54 IF (CF(8).EQ.0.0D0.AND.CF(9).EQ.0.0D0) GO TO 55                   RL  887
C***  CONVERT TEMPERATURE TO DEGREES RANKINE                           RL  888
      D(I,7)=CF(8)*D(I,7)+CF(9)                                         RL  889
   55 IF (CF(10).EQ.0.0D0) GO TO 56                                     RL  890
C***  CONVERT LONGITUDINAL ACCELERATION TO FT/SEC**2                   RL  891
      D(I,8)=D(I,8)*CF(10)                                              RL  892
   56 IF (CF(11).EQ.0.0D0) GO TO 57                                     RL  893
C***  CONVERT VERTICAL ACCELERATION TO FT/SEC**2                       RL  894
      D(I,10)=D(I,10)*CF(11)                                            RL  895
   57 IF (CF(12).EQ.0.0D0) GO TO 58                                     RL  896
C***  CONVERT ELEVATOR (OR STABILATOR) DEFLECTION TO RADIANS           RL  897
      D(I,11)=D(I,11)*CF(12)                                            RL  898
   58 CONTINUE                                                          RL  899
C***  ADJUST DATA FOR AN ASSUMED PHASE SHIFT                           RL  900
      IF (NSPTS.NE.0) CALL SHIFT(K,LSP,NSPTS)                           RL  901
C***  COMPUTE PITCH ANGLE BIAS                                         RL  902
      PAB=CARSIN(D(K,8)/G)-D(K,2)                                       RL  903
C***  ADD PITCH ANGLE BIAS TO PITCH ANGLE                              RL  904
      DO 59 I=1,K                                                       RL  905
   59 D(I,2)=D(I,2)+PAB                                                 RL  906
C***  INTEGRATE PITCH RATE                                             RL  907
      PBI=0.0D0                                                         RL  908
      KM1=K-1                                                           RL  909
      DO 60 I=1,KM1                                                     RL  910
   60 PBI=PBI+0.5D0*(TIME(I+1)-TIME(I))*(D(I+1,3)+D(I,3))               RL  911
C***  COMPUTE PITCH RATE BIAS                                          RL  912
      PBB=-(PBI+D(1,2)-D(K,2))/TT                                       RL  913
C***  ADD PITCH RATE BIAS TO PITCH RATE                                RL  914
      DO 61 I=1,K                                                       RL  915
   61 D(I,3)=D(I,3)+PBB                                                 RL  916
C***  INITIALIZE PARAMETERS FOR PHASE SHIFT DETERMINATION              RL  917
      NSPTS=0                                                           RL  918
      L=1                                                               RL  919
   62 NEC=K-NSPTS                                                       RL  920
      SIS=0.0D0                                                         RL  921
C***  START SUMMATION PROCESS                                          RL  922
      DO 64 I=1,NEC                                                     RL  923
C***  INTEGRATE PITCH RATE                                             RL  924
      PBI=D(1,2)                                                        RL  925
      DO 63 J=1,I                                                       RL  926
      IF (J.EQ.1) GO TO 63                                              RL  927
      PBI=PBI+0.5D0*(TIME(J)-TIME(J-1))*(D(J,3)+D(J-1,3))               RL  928
   63 CONTINUE                                                          RL  929
C***  SUM PRODUCTS OF PITCH ANGLES                                     RL  930
   64 SIS=SIS+(PBI-D(K,2))*(D(I+NSPTS,2)-D(K,2))                        RL  931
C***  STORE VALUES                                                     RL  932
      SVPC(L)=SIS                                                       RL  933
      NVPC(L)=NSPTS                                                     RL  934
C***  TEST FOR MAXIMUM PHASE SHIFT                                     RL  935
      IF (NSPTS.EQ.10) GO TO 65                                         RL  936
C***  INCREASE PHASE SHIFT AND COUNTER                                 RL  937
      NSPTS=NSPTS+1                                                     RL  938
      L=L+1                                                             RL  939
      GO TO 62                                                          RL  940
C***  DETERMINE MAXIMUM PITCH-ANGLE PRODUCT                            RL  941
   65 SIS=SVPC(1)                                                       RL  942
      DO 66 I=1,10                                                      RL  943
   66 IF (SVPC(I).GT.SIS) SIS=SVPC(I)                                   RL  944
      DO 67 I=1,10                                                      RL  945
      L=I                                                               RL  946
   67 IF (SVPC(I).EQ.SIS) GO TO 68                                      RL  947
   68 NSPTS=NVPC(L)                                                     RL  948
      WRITE (JWRITE,69) NSPTS,PAB,PBB                                   RL  949
   69 FORMAT (1H,//,35X,31HCALCULATED PHASE SHIFT COUNT = ,I2,/,35X,31HC RL  950
     1ALCULATED PITCH ANGLE BIAS  = ,1PD19.12,7H RADIAN,/,35X,31HCALCULA RL  951
     1TED PITCH RATE BIAS  = ,1PD19.12,8H RAD/SEC)                      RL  952
C***  ADJUST DATA POINTS, IF NECESSARY, FOR A CALCULATED PHASE SHIFT   RL  953
      IF (NSPTS.NE.0) CALL SHIFT(K,LSP,NSPTS)                           RL  954
C***  COMPUTE PARAMETERS FOR TOTAL TEMPERATURE                         RL  955
      RPI=(3*MCH(N))/2                                                  RL  956
      RPIP1=RPI+1                                                       RL  957
      ITEST=0                                                           RL  958
C***  INITIALIZE IMPROVEMENT COEFFICIENTS                              RL  959
      DO 70 I=1,6                                                       RL  960
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   70 PAB(I)=0.0D0                                                      NL  961
      IPAB=0                                                            NL  962
      IF (NUMBER.LT.0)NUMBER=0                                          NL  963
      NUM=NUMBER+1                                                      NL  964
C***  BEGIN IMPROVEMENT ITERATION                                       NL  965
      DO 119 JJJJ=1,NUM                                                 NL  966
      TD=TIME(K)-TIME(1)                                                NL  967
      DO 71 I=1,K                                                       NL  968
      TK=TIME(I)-TIME(1)                                                NL  969
      P1(I)=D(I,7)-(D(1,7)+(D(K,7)-D(1,7))/TD*TK)                       NL  970
   71 CONTINUE                                                          NL  971
C***  COMPUTE AND SMOOTH FOURIER COEFFICIENTS OF STAGNATION TEMPERATURE NL  972
      CALL PARAF(P1,K,MPTP1,NCH(4))                                     NL  973
C***  REGENERATE SMOOTHED STAGNATION TEMPERATURE                        NL  974
      X1=A(1)                                                           NL  975
      DO 73 L=1,K                                                       NL  976
      TK=TIME(L)-TIME(1)                                                NL  977
      X2=D(1,7)+(D(K,7)-D(1,7))/TD*TK                                   NL  978
      X3=0.0D0                                                          NL  979
      DO 72 N=2,MPTP1                                                   NL  980
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L NL  981
     1)/TT)                                                             NL  982
   72 CONTINUE                                                          NL  983
      P1(L)=X1+X2+X3                                                    NL  984
   73 CONTINUE                                                          NL  985
C***  DETERMINE FEASIBILITY OF STATIC PRESSURE BEHAVIOR AND MAKE ANY    NL  986
C***  NECESSARY CORRECTIONS                                             NL  987
      KM1=K-1                                                           NL  988
      DO 74 I=1,KM1                                                     NL  989
      SN=1.0D0                                                          NL  990
C***  CALCULATE AN ALTITUDE BY ASSUMING CONSTANT TEMPERATURE            NL  991
      H=(1.0D0-(D(I,5)/PSI)**(1.0D0/4.26D0))/6.8D-6                     NL  992
C***  CALCULATE A LIMITING ALTITUDE DERIVATIVE MAGNITUDE                NL  993
      HD=DABS(D(I,4)*DSIN(1.2DC*(D(I,2)-D(I,6))))                       NL  994
C***  CALCULATE A LIMITING STATIC PRESSURE DERIVATIVE MAGNITUDE         NL  995
      PDPA=DABS(-6.86D-6*4.26D0*PSI*HD*(1.0D0-6.86D-6*H)**3.26D0)       NL  996
C***  CALCULATE TWO-POINT STATIC PRESSURE DERIVATIVE OF INPUT DATA      NL  997
      PPI=(D(I+1,5)-D(I,5))/(TIME(I+1)-TIME(I))                         NL  998
C***  DETERMINE DIRECTION OF DERIVATIVE                                 NL  999
      IF (DABS(PPI).NE.PPI)SN=-1.0D0                                    NL 1000
C***  CHECK MAGNITUDES OF STATIC PRESSURE DERIVATIVES AND APPLY SMALLEST NL 1001
      IF (DABS(PPI).LE.DABS(PDPA))ASLP=DABS(PPI)                        NL 1002
      IF (DABS(PPI).GT.DABS(PDPA))ASLP=DABS(PDPA)                       NL 1003
C***  COMPUTE 'NEW' STATIC PRESSURE                                     NL 1004
      D(I+1,5)=D(1,5)+SN*ASLP*(TIME(I+1)-TIME(I))                       NL 1005
   74 CONTINUE                                                          NL 1006
C***  DEFINE STATIC AND STAGNATION PRESSURES                            NL 1007
      DO 75 I=1,K                                                       NL 1008
      ASPD(I)=D(I,4)                                                    NL 1009
      D(I,7)=P1(I)                                                      NL 1010
      P(I)=D(I,5)                                                       NL 1011
      PA(I)=D(I,5)                                                      NL 1012
      PS(I)=P(I)+0.5D0*PSI/(R*TSL)*D(I,4)**2                            NL 1013
   75 CONTINUE                                                          NL 1014
C***  COMPUTE LAG-CORRECTED STATIC PRESSURE AND QC                      NL 1015
      MP=(3*NCH(1))/2                                                   NL 1016
      MPA=(3*NCH(2))/2                                                  NL 1017
      MPS=(3*NCH(3))/2                                                  NL 1018
      MPP1=MP+1                                                         NL 1019
      MPAP1=MPA+1                                                       NL 1020
      MPSP1=MPS+1                                                       NL 1021
      TD=TIME(K)-TIME(1)                                                NL 1022
C***  COMPUTE DEVIATIONS OF STATIC PRESSURES AND STAGNATION PRESSURE    NL 1023
      DO 76 I=1,K                                                       NL 1024
      TK=TIME(I)-TIME(1)                                                NL 1025
      P1(I)=P(I)-(P(1)+(P(K)-P(1))/TD*TK)                               NL 1026
      P2(I)=PA(I)-(PA(1)+(PA(K)-PA(1))/TD*TK)                           NL 1027
   76 P3(I)=PS(I)-(PS(1)+(PS(K)-PS(1))/TD*TK)                           NL 1028
C***  SET TIME CONSTANTS AND TIME INTERVALS TO ZERO IF SPECIFIED        NL 1029
      IF (JJJJ.EQ.1)  GC TC 78                                          NL 1030
      DO 77 I=1,3                                                       NL 1031
      XLM(I)=0.0D0                                                      NL 1032
   77 TAU(I)=0.0D0                                                      NL 1033
C***  COMPUTE AND SMOOTH FOURIER COEFFICIENTS OF AIRSPEED'S STATIC      NL 1034
C***  PRESSURE                                                          NL 1035
   78 CALL PARAF(P1,K,MPP1,NCH(1))                                      NL 1036
C***  REGENERATE AIRSPEED'S SMOOTHED STATIC PRESSURE AT (TIME-LAMBDA)   NL 1037
      X1=A(1)                                                           NL 1038
      DC 80 L=1,K                                                       NL 1039
      TK=TIME(L)-TIME(1)-XLM(3)                                         NL 1040
      X2=P(1)+(P(K)-P(1))/TD*TK                                         NL 1041
      X3=0.0D0                                                          NL 1042
      DC 79 N=2,MPP1                                                    NL 1043
      X3=X3+A(N)*DCOS(2*(N-1)*PI*(TIME(L)-XLM(3))/TT)+B(N)*DSIN(2*(N-1)* NL 1044
     1PI*(TIME(L)-XLM(3))/TT)                                           NL 1045
   79 CONTINUE                                                          NL 1046
      P1(L)=X1+X2+X3                                                    NL 1047
   80 CONTINUE                                                          NL 1048
C***  COMPUTE DERIVATIVE OF AIRSPEED'S STATIC PRESSURE AT (TIME-LAMBDA) NL 1049
      XD1=(P(K)-P(1))/TD                                                NL 1050
      DO 82 L=1,K                                                       NL 1051
      XD2=0.0D0                                                         NL 1052
      DO 81 N=1,MP                                                      NL 1053
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*(TIME(L)-XLM(3))/TT)+B(N+1) NL 1054
     1*DCOS(2*N*PI*(TIME(L)-XLM(3))/TT))                                NL 1055
   81 CONTINUE                                                          NL 1056
      PD(L)=XD1+XD2                                                     NL 1057
   82 CONTINUE                                                          NL 1058
C***  COMPUTE FULLY LAG-CORRECTED STATIC PRESSURE FOR AIRSPEED          NL 1059
      DC 83 L=1,K                                                       NL 1060
      P(L)=P1(L)+TAU(3)*PD(L)                                           NL 1061
      IF (L.EQ.K)P(L)=P(L-1)                                            NL 1062
   83 CONTINUE                                                          NL 1063
C***  COMPUTE AND SMOOTH FOURIER COEFFICIENTS OF ALTITUDE'S STATIC      NL 1064
C***  PRESSURE                                                          NL 1065
      CALL PARAF(P2,K,MPAP1,NCH(2))                                     NL 1066
C***  REGENERATE ALTITUDE'S SMOOTHED STATIC PRESSURE AT (TIME-LAMBDA)   NL 1067
      X1=A(1)                                                           NL 1068
      DO 85 L=1,K                                                       NL 1069
      TK=TIME(L)-TIME(1)-XLM(2)                                         NL 1070
      X2=PA(1)+(PA(K)-PA(1))/TD*TK                                      NL 1071
      X3=0.0D0                                                          NL 1072
      DO 84 N=2,MPAP1                                                   NL 1073
      X3=X3+A(N)*DCOS(2*(N-1)*PI*(TIME(L)-XLM(2))/TT)+B(N)*DSIN(2*(N-1)* NL 1074
     1PI*(TIME(L)-XLM(2))/TT)                                           NL 1075
   84 CONTINUE                                                          NL 1076
      P2(L)=X1+X2+X3                                                    NL 1077
   85 CONTINUE                                                          NI 1078
C***  COMPUTE DERIVATIVE OF ALTITUDE'S STATIC PRESSURE AT (TIME-LAMBDA) NL 1079
      XD1=(PA(K)-PA(1))/TD                                              NL 1080
```

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      DO 87 L=1,K                                                       RL 1081
      XD2=0.0D0                                                         RL 1082
      DO 86 N=1,NPA                                                     RL 1083
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*(TIME(L)-XLN(2))/TT)*B(N+1) RL 1084
     1*DCOS(2*N*PI*(TIME(L)-XLN(2))/TT))                                RL 1085
   86 CONTINUE                                                          RL 1086
      PD(L)=XD1+XD2                                                     RL 1087
   87 CONTINUE                                                          RL 1088
C***  COMPUTE FULLY LAG-CORRECTED STATIC PRESSURE FOR ALTITUDE          RL 1089
      DO 88 L=1,K                                                       RL 1090
      PA(L)=P2(L)+TAU(2)*PD(L)                                          RL 1091
      IF (L.EQ.1) PA(L)=PA(L-1)                                         RL 1092
   88 CONTINUE                                                          RL 1093
C***  COMPUTE AND SMOOTH FOURIER COEFFICIENTS OF STAGNATION PRESSURE    RL 1094
      CALL PARAF(P3,K,NPSP1,NCH(3))                                     RL 1095
C***  REGENERATE SMOOTHED STAGNATION PRESSURE AT (TIME-LAMBDA)          RL 1096
      X1=A(1)                                                           RL 1097
      DO 90 L=1,K                                                       RL 1098
      TX=TIME(L)-TIME(1)-XLN(1)                                         RL 1099
      X2=ES(1)+(PS(K)-PS(1))/XD*TX                                      RL 1100
      X3=0.0D0                                                          RL 1101
      DO 89 N=2,NPSP1                                                   RL 1102
      X3=X3+A(N)*DCOS(2*(N-1)*PI*(TIME(L)-XLN(1))/TT)+B(N)*DSIN(2*(N-1)* RL 1103
     1PI*(TIME(L)-XLN(1))/TT)                                           RL 1104
   89 CONTINUE                                                          RL 1105
      P3(L)=X1+X2+X3                                                    RL 1106
   90 CONTINUE                                                          RL 1107
C***  COMPUTE DERIVATIVE OF STAGNATION PRESSURE AT (TIME-LAMBDA)        RL 1108
      XD1=(PS(K)-PS(1))/TD                                              RL 1109
      DO 92 L=1,K                                                       RL 1110
      XD2=0.0D0                                                         RL 1111
      DO 91 N=1,NPS                                                     RL 1112
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*(TIME(L)-XLN(1))/TT)*B(N+1) RL 1113
     1*DCOS(2*N*PI*(TIME(L)-XLN(1))/TT))                                RL 1114
   91 CONTINUE                                                          RL 1115
      PSD(L)=XD1+XD2                                                    RL 1116
   92 CONTINUE                                                          RL 1117
C***  COMPUTE FULLY LAG-CORRECTED STAGNATION PRESSURE                   RL 1118
      DO 93 L=1,K                                                       RL 1119
      PS(L)=P3(L)+TAU(1)*PSD(L)                                         RL 1120
      IF (L.EQ.K) PS(L)=PS(L-1)                                         RL 1121
   93 CONTINUE                                                          RL 1122
      RP1=RHO*TSL/PSL                                                   RL 1123
      DPQC=-2000.0D0                                                    RL 1124
      NPTS81=NPTS-1                                                     RL 1125
C***  SPLINE FIT POSITION ERROR CORRECTION RATIO DP/QC* WITH RESPECT TO  RL 1126
C***  INDICATED AIRSPEED                                                RL 1127
      CALL SPLINE(NPTS,DPQCP,VE,AA)                                     RL 1128
C***  CALCULATE INDICATED AIRSPEED                                      RL 1129
      DO 97 I=1,K                                                       RL 1130
C***  THE MEASURED INDICATED AIRSPEED IS USED IN CONJUNCTION WITH THE   RL 1131
C***  INDICATED POSITION-ERROR-CORRECTION AIRSPEED TO FIND DPQC         RL 1132
      VIND=ASPD(I)                                                      RL 1133
C***  INTERPOLATE FOR APPLICATION OF CORRECTION RATIO                   RL 1134
      IF (VIND.LT.VE(1)) DPQC=DPQCP(1)                                  RL 1135
      IF (VIND.GT.VE(NPTS)) DPQC=DPQCP(NPTS)                            RL 1136
      IF (DPQC.EQ.DPQCP(1).OR.DPQC.EQ.DPQCP(NPTS)) GO TO 96             RL 1137
      DO 94 J=1,NPTS81                                                  RL 1138
      IF (VE(J).LE.VIND.AND.VE(J+1).GT.VIND) GO TO 95                   RL 1139
   94 CONTINUE                                                          RL 1140
      J=NPTS81                                                          RL 1141
   95 CX1=AA(1,J)                                                       RL 1142
      CX2=AA(2,J)                                                       RL 1143
      CX3=AA(3,J)                                                       RL 1144
      CX4=AA(4,J)                                                       RL 1145
C***  COMPUTE INTERPOLATED CORRECTION RATIO                             RL 1146
      DPQC=((CX1*VIND+CX2)*VIND+CX3)*VIND+CX4                           RL 1147
   96 PP=P(I)                                                           RL 1148
      IF (DPQC.EQ.-2000.0D0) IERR=1                                     RL 1149
      IF (IERR.NE.0) GO TO 117                                          RL 1150
      PH=PA(I)                                                          RL 1151
      PP=PS(I)-P(I)                                                     RL 1152
      DP=DPQC*PP                                                        RL 1153
      PL=PP+DP                                                          RL 1154
      PLH=PH+DP                                                         RL 1155
C***  COMPUTE STATIC TEMPERATURE FROM STAGNATION TEMPERATURE, DENSITY   RL 1156
C***  FROM STATIC PRESSURE, ALTITUDE FROM DENSITY, AND TRUE AIRSPEED    RL 1157
C***  FROM INDICATED AIRSPEED                                           RL 1158
      ST(I,1)=D(I,7)                                                    RL 1159
      D(I,7)=D(I,7)/((1.0D0+PH/PP)/(PH/PP+DPQC))**((GAMMA-1.0D0)/GAMMA) RL 1160
      ST(I,2)=D(I,5)                                                    RL 1161
      D(I,5)=RPT*(PLH/D(I,7))                                           RL 1162
      D(I,9)=(1.0D0-(D(I,5)/RHO)**(1.0D0/4.26D0))/6.86D-6               RL 1163
      ST(I,3)=D(I,4)                                                    RL 1164
      ST(I,4)=D(I,8)                                                    RL 1165
      D(I,4)=DSQRT(2.0D0*GAMMA*PL/((GAMMA-1.0D0)*D(I,5))*(((1.0D0+PP/PP) RL 1166
     1/(PE/PP+DPQC))**((GAMMA-1.0D0)/GAMMA)-1.0D0))                     RL 1167
C***  CORRECT PITCH ANGLE AND ANGLE OF ATTACK FOR INSTRUMENT LOCATION   RL 1168
      IF (JJJJ.GT.1) GO TO 97                                           RL 1169
      E(I,2)=E(I,2)+PCCG                                                RL 1170
      D(I,6)=E(I,6)-DATAN(XACG*D(I,3)/D(I,4))                           RL 1171
C***  CALIBRATE ANGLE OF ATTACK                                         RL 1172
      IF (CALP1.EQ.0.0D0) CALP1=1.0D0                                   RL 1173
      D(I,6)=CALP1*D(I,6)+CALP2                                         RL 1174
   97 CONTINUE                                                          RL 1175
C***  CHECK FOR INITIAL PRINTOUT                                        RL 1176
      IF (JJJJ.GT.1) GO TO 116                                          RL 1177
C***  WRITE RESULTS IN COMPATIBLE UNITS                                 RL 1178
      IF (PRTBIC.NE.0) GO TO 109                                        RL 1179
C***  WRITE RESULTS IN ENGLISH UNITS                                    RL 1180
      WRITE (JWRITE,98)                                                 RL 1181
   98 FORMAT (1H,///,31X,68('*')/,31X,'*',66X,'*'/,31X,'*',6X,53HCONVER RL 1182
     1SION OF INITIAL FLIGHT DATA TO COMPATIBLE UNITS,7X,'*'/,31X,'*',6 RL 1183
     16X,'*'/,31X,68('*')/,6X,121('*')/,6X,'*',19X,'|',19X,'|',19X,'|', RL 1184
     1'|',19X,'|',19X,'|',19X,'*'/,6X,'*',4X,16HDATA POINT,5X,'|',7X,4HTI RL 1185
     1ME,8X,'|',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH  RL 1186
     1RATE,5X,'|',5X,8HAIRSPEED,6X,'*'/,6X,'*',19X,'|',6X,6H(SECS),7X,'  RL 1187
     1|',7X,5H(LBF),7X,'|',8X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'  RL 1188
     1|',5X,8H(FT/SEC),6X,'*'/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',1 RL 1189
     19X,'|',19X,'*'/,6X,'*',119('-'),'*')                              RL 1190
      DO 100 I=1,K                                                      RL 1191
      WRITE (JWRITE,99) I,TIME(I),(D(I,J),J=1,4)                        RL 1192
   99 FORMAT (6X,'*',7X,I3,9X,'|',6X,F7.3,6X,'|',5X,F9.3,5X,'|',3X,F11.7 RL 1193
     1,5X,'|',4X,F10.7,5X,'|',5X,F8.4,6X,'*')                           RL 1194
  100 CONTINUE                                                          RL 1195
      WRITE (JWRITE,101)                                                RL 1196
  101 FORMAT (6X,'*',119X,'*'/,6X,121('*')/,6X,'*',19X,'|',19X,'|',19X RL 1197
     1,'|',19X,'|',19X,'|',19X,'*'/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4 RL 1198
     1HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',4X,1 RL 1199
     11HTEMPERATURE,6X,'|',3X,12HINCMG. ACCEL.,4X,'*'/,6X,'*',19X,'|',6X RL 1200
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     1,6H(SECS),7X,'|',3X,12H(SLUG/FT**3),4X,'|',4X,9H(RADIANS),6X,'|',6  NL 1201
     1X,7H(DEG-R),6X,'|',4X,11H(FT/SEC**2),4X,'**',/,6X,'**',19X,'|',19X,'  NL 1202
     1|',19X,'|',19X,'|',19X,'|',19X,'**',/,6X,'**',119('-'),'**')        NL 1203
       DO 103 I=1,K                                                       NL 1204
       WRITE (JWRITE,102) I,TIME(I),(D(I,J),J=5,8)                        NL 1205
  102 FORMAT (6X,'**',7X,I3,9X,'|',6X,F7.3,6X,'|',4X,F10.8,5X,'|',4X,F11.  NL 1206
     17,4X,'|',4X,F9.2,6X,'|',4X,F9.5,6X,'**')                            NL 1207
  103 CONTINUE                                                            NL 1208
       WRITE (JWRITE,104)                                                 NL 1209
  104 FORMAT (6X,'**',119X,'**',/,6X,121('**'))                           NL 1210
       WRITE (JWRITE,105)                                                 NL 1211
  105 FORMAT (6X,'**',19X,'|',19X,'|',19X,'|',19X,'|',19X,'**',/,6X,'**',4X NL 1212
     1,10HDATA POINT,5X,'|',7X,4HTIME,8X,'|',5X,8HALTITUDE,6X,'|',3X,12H  NL 1213
     1VERT. ACCEL.,4X,'|',2X,14HELEV. DEFLECT.,3X,'**',/,6X,'**',19X,'|',6 NL 1214
     1X,6H(SECS),7X,'|',6X,6H(FEET),7X,'|',4X,11H(FT/SEC**2),4X,'|',4X,9  NL 1215
     1H(RADIANS),6X,'**',/,6X,'**',19X,'|',19X,'|',19X,'|',19X,'|',19X,'** NL 1216
     1,/,6X,'**',99('-'),'**')                                            NL 1217
       DO 107 I=1,K                                                       NL 1218
       WRITE (JWRITE,106) I,TIME(I),(D(I,J),J=9,11)                       NL 1219
  106 FORMAT (6X,'**',7X,I3,9X,'|',6X,F7.3,6X,'|',4X,F10.3,5X,'|',4X,F9.5  NL 1220
     1,6X,'|',4X,F9.5,6X,'**')                                            NL 1221
  107 CONTINUE                                                            NL 1222
       WRITE (JWRITE,108)                                                 NL 1223
  108 FORMAT (6X,'**',19X,'|',19X,'|',19X,'|',19X,'|',19X,'**',/,6X,101('** NL 1224
     1'))                                                                 NL 1225
       GO TO 116                                                          NL 1226
C***  WRITE RESULTS IN SI UNITS                                           NL 1227
  109 WRITE (JWRITE,110)                                                  NL 1228
  110 FORMAT (1H,//,31X,68('**'),/,31X,'**',66X,'**',/,31X,'**',6X,53HCONVER NL 1229
     1SION OF INITIAL FLIGHT DATA TO COMPATIBLE UNITS,7X,'**',/,31X,'**',6 NL 1230
     16X,'**',/,31X,68('**'),/,6X,121('**'),/,6X,'**',19X,'|',19X,'|',19X,' NL 1231
     1',19X,'|',19X,'|',19X,'**',/,6X,'**',4X,10HDATA POINT,5X,'|',7X,4HTI NL 1232
     1ME,8X,'|',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH   NL 1233
     1RATE,5X,'|',5X,6HAIRSPEED,6X,'**',/,6X,'**',19X,'|',6X,6H(SECS),7X,' NL 1234
     1|',5X,9H(NEWTONS),5X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),  NL 1235
     14X,'|',6X,7H(M/SEC),6X,'**',/,6X,'**',19X,'|',19X,'|',19X,'|',19X,'| NL 1236
     1',19X,'|',19X,'**',/,6X,'**',119('-'),'**')                         NL 1237
       DO 111 I=1,K                                                       NL 1238
       WS=D(I,1)*4.4482D0                                                 NL 1239
       VS=D(I,4)*0.3048D0                                                 NL 1240
       WRITE (JWRITE,99) I,TIME(I),WS,D(I,2),D(I,3),VS                    NL 1241
  111 CONTINUE                                                            NL 1242
       WRITE (JWRITE,112)                                                 NL 1243
  112 FORMAT (6X,'**',119X,'**',/,6X,121('**'),/,6X,'**',19X,'|',19X,'|',19X NL 1244
     1,'|',19X,'|',19X,'|',19X,'**',/,6X,'**',4X,10HDATA POINT,5X,'|',7X,4 NL 1245
     1HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',4X,1  NL 1246
     11HTEMPERATURE,4X,'|',3X,12HICNG. ACCEL.,4X,'**',/,6X,'**',19X,'|',6X NL 1247
     1,6H(SECS),7X,'|',4X,9H(KG/M**3),6X,'|',5X,9H(RADIANS),5X,'|',6X,7H  NL 1248
     1(DEG-K),6X,'|',4X,10H(M/SEC**2),5X,'**',/,6X,'**',19X,'|',19X,'|',19 NL 1249
     1X,'|',19X,'|',19X,'|',19X,'**',/,6X,'**',119('-'),'**')             NL 1250
       DO 113 I=1,K                                                       NL 1251
       DS=D(I,5)*515.38C0                                                 NL 1252
       AS=D(I,8)*0.3048D0                                                 NL 1253
       TK=D(I,7)*0.555556D0                                               NL 1254
  113 WRITE (JWRITE,102) I,TIME(I),DS,D(I,6),TK,AS                        NL 1255
       WRITE (JWRITE,104)                                                 NL 1256
       WRITE (JWRITE,114)                                                 NL 1257
  114 FORMAT (6X,'**',19X,'|',19X,'|',19X,'|',19X,'|',19X,'**',/,6X,'**',4X NL 1258
     1,10HDATA POINT,5X,'|',7X,4HTIME,8X,'|',5X,8HALTITUDE,6X,'|',3X,12H  NL 1259
     1VERT. ACCEL.,4X,'|',2X,14HELEV. DEFLECT.,3X,'**',/,6X,'**',19X,'|',6 NL 1260
     1X,6H(SECS),7X,'|',5X,8H(METERS),6X,'|',4X,10H(M/SEC**2),5X,'|',4X,  NL 1261
     19H(RADIANS),6X,'**',/,6X,'**',19X,'|',19X,'|',19X,'|',19X,'|',19X,'** NL 1262
     1',/,6X,'**',99('-'),'**')                                           NL 1263
       DO 115 I=1,K                                                       NL 1264
       HS=D(I,9)*0.3048D0                                                 NL 1265
       VAS=D(I,10)*0.3048D0                                               NL 1266
       WRITE (JWRITE,106) I,TIME(I),HS,VAS,D(I,11)                        NL 1267
  115 CONTINUE                                                            NL 1268
       WRITE (JWRITE,108)                                                 NL 1269
C***  EXACT FOURIER ANALYSIS AND FILTERING ROUTINE                        NL 1270
  116 CALL SEC2(K,JJJJ,NUM,LSP,ITEST,S)                                   NL 1271
  117 IF (IERR.NE.0) WRITE (JWRITE,118)                                   NL 1272
  118 FORMAT (1X,////,15X,'USER ERROR***CONSULT USER INSTRUCTIONS***TO M  NL 1273
     1EXT DATA SET, IF ANY',////)                                         NL 1274
       IF (IERR.NE.0.OR.ITEST.NE.0) GO TO 120                             NL 1275
  119 CONTINUE                                                            NL 1276
  120 KJ=KJ+1                                                             NL 1277
C***  CHECK FOR PRESENCE OF ADDITIONAL DATA SETS                          NL 1278
       IF ((KJ-1).EQ.NSETS) GO TO 5                                       NL 1279
       IF (KJ.LE.NSETS) GO TO 3                                           NL 1280
C***  TERMINATE PROGRAM EXECUTION                                         NL 1281
  121 WRITE (JWRITE,122)                                                  NL 1282
  122 FORMAT (1X,////,15X,56HINPUT PARAMETER NSETS IS PROBABLY SPECIFIED  NL 1283
     1 INCORRECTLY.,////)                                                 NL 1284
C***  TERMINATE PLOT ROUTINES                                             NL 1285
  123 IF (JPLOT.NE.0) CALL PICSIZ(0.0,0.0)                                NL 1286
       STOP                                                               NL 1287
       END                                                                NL 1288
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       SUBROUTINE SEC2(K,JP,NUM,LSP,ITEST,S)                             S2    1
C                                                                        S2    2
C***  SUBROUTINE SEC2 IS A SUBROUTINE THAT PERFORMS FOURIER ANALYSIS AND  S2    3
C***  ATTEMPTS TO MAKE THE DATA MORE COMPATIBLE                           S2    4
C                                                                        S2    5
       IMPLICIT REAL*8(A-H,O-Z)                                          S2    6
       DIMENSION TRG(21),IB(6),DY(450),DX(450),AX(450),FX(450),DV(450),HD S2    7
      1(450),H(450),IFS(11),IPRC(9),IP(14),MC(11),SS(450,11),LSP(9),TST(4 S2    8
      150,16)                                                            S2    9
       COMMON TITLE(20),D(450,11),TIME(450),A(100),B(100),F1(450),F2(450) S2   10
      1,F3(450),F4(450),F5(450),F6(450),F7(450),F8(450),TT,RHO,PI,G,JKS,M S2   11
      1ETRIC,JREAD,JWRITE,JPUNCH,IERR                                    S2   12
       COMMON /CABRT/F11(450),F12(450)                                   S2   13
       COMMON /TEMP1/SI(450,4),PAR(6),PSL,TSL,IPAR                       S2   14
       COMMON /TEMP2/F9(450),F10(450),F13(450),F14(450),AP(6),W(6)       S2   15
       COMMON /RCM/IRS(10,6)                                             S2   16
       DATA TRG/.0DC,5.0D0,10.0D0,15.0D0,20.0D0,25.0D0,30.0D0,35.0D0,40.0 S2   17
      1D0,45.0D0,50.0D0,55.0D0,60.0D0,65.0D0,70.0D0,75.0D0,80.0D0,85.0D0, S2   18
      190.0D0,95.0D0,100.0D0/,MS/15/,MI/3/                               S2   19
C                                                                        S2   20
C                                                                        S2   21
C                                                                        S2   22
C***  CHECK OR BYPASS                                                    S2   23
       IF (JP.GT.1) GO TO 10                                             S2   24
C                                                                        S2   25
C                                                                        S2   26
       READ (JREAD,1) (IFS(I),I=1,11)                                    S2   27
     1 FORMAT (11I1)                                                     S2   28
C                                                                        S2   29
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```
C
      READ (JREAD,2) (IPRC(I),I=1,9),XAX,FAC1,FAC2,DSPS
    2 FORMAT (9I1,I1,4D15.0)
C
C***  CHECK FOR INPUT ERROR
      IF (IPRC(1).NE.0.AND.IPRC(2).EQ.2) GO TO 64
C
C
      READ (JREAD,3)  (IP(I),I=1,14)
    3 FORMAT (14I1)
C
C
      READ (JREAD,4)  (NC(I),I=1,11)
    4 FORMAT (11I5)
C
C
      READ (JREAD,5)  (AP(I),W(I),I=1,6,
    5 FORMAT (2D20.0)
C
C
      NUMX=NUM-1
      IF(NUMX.EQ.0)  NUMX=1
      DO 6 J=1,NUMX
      READ (JREAD,6)  (IR(I),I=1,6)
    6 FORMAT (6I1)
C
C
C
      DO 7 JJ=1,6
    7 IRS(J,JJ)=IR(JJ)
    8 CONTINUE
C***  CHECK FOR ZERO OR MEAS-ZERO A PRIORI VALUE
      DO 9 I=1,6
      IF (DABS(AP(I)).LT.1.0D-10)AP(I)=1.0D-10
    9 CONTINUE
C***  ADJUST TO ODD NUMBER OF POINTS
   10 IF (((K/2)*2).EQ.K)K=K-1
      K1=K
      TX=TIME(K)-TIME(1)
C***  DEFINE NEW ARRAYS
      DO 11 I=1,K
C***  DEFINE WEIGHT
      F1(I)=D(I,1)
C***  DEFINE PITCH ANGLE
      F2(I)=D(I,2)
C***  DEFINE PITCH RATE
      F3(I)=D(I,3)
C***  DEFINE AIRSPEED
      F4(I)=D(I,4)
C***  DEFINE DENSITY
      F5(I)=D(I,5)
C***  DEFINE ANGLE OF ATTACK
      F6(I)=D(I,6)
C***  DEFINE TEMPERATURE
      F7(I)=D(I,7)
C***  DEFINE LONGITUDINAL ACCELERATION
      F8(I)=D(I,8)
      AX(I)=D(I,8)
C***  DEFINE ALTITUDE
      F10(I)=D(I,9)
```

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S2  30
S2  31
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S2  84
S2  85
S2  86
S2  87
S2  88
S2  89
```

```
C***  INITIALIZE ALTITUDE RATE                                          S2  90
      F11(I)=0.0D0                                                      S2  91
C***  DEFINE VERTICAL ACCELERATION                                      S2  92
      F13(I)=D(I,10)                                                    S2  93
C***  DEFINE ELEVATOR (OR STABILATOR) DEFLECTION                        S2  94
      F14(I)=D(I,11)                                                    S2  95
   11 CONTINUE                                                          S2  96
C***  STORE INITIAL DATA FOR PLOTTING                                   S2  97
      IF (IPRC(5).NE.0.OR.JP.NE.1) GO TO 13                             S2  98
      DO 12 I=1,K                                                       S2  99
      DO 12 J=1,11                                                      S2 100
   12 SS(I,J)=D(I,J)                                                    S2 101
C***  CHECK FOR OVERALL FOURIER SERIES ANALYSIS                         S2 102
   13 IF (IPRC(4).NE.0) GO TO 92                                        S2 103
C***  COMPUTE TERMINATION HARMONICS                                     S2 104
      M1=(3*NC(1))/2                                                    S2 105
      M2=(3*NC(2))/2                                                    S2 106
      M3=(3*NC(3))/2                                                    S2 107
      M4=(3*NC(4))/2                                                    S2 108
      M5=(3*NC(5))/2                                                    S2 109
      M6=(3*NC(6))/2                                                    S2 110
      M7=(3*NC(7))/2                                                    S2 111
      M8=(3*NC(8))/2                                                    S2 112
      M9=(3*NC(9))/2                                                    S2 113
      M10=(3*NC(10))/2                                                  S2 114
      M11=(3*NC(11))/2                                                  S2 115
C***  CHECK FOR INCORRECT INPUT                                         S2 116
      IF ((((IFS(1).EQ.0.AND.M1.LE.0).OR.((IFS(2).EQ.0.AND.M2.LE.0).OR.( S2 117
     1IFS(3).EQ.0.AND.M3.LE.0))).OR.(((IFS(4).EQ.0.AND.M4.LE.0).OR.(IFS( S2 118
     15).EQ.0.AND.M5.LE.0)).OR.((IFS(6).EQ.0.AND.M6.LE.0).OR.(IFS(7).EQ. S2 119
     10.AND.M7.LE.0)))).OR.((((IFS(8).EQ.0.AND.M8.LE.0).OR.(IFS(9).EQ.0. S2 120
     1AND.M9.LE.0)).OR.((IFS(10).EQ.0.AND.M10.LE.0).OR.(IFS(11).EQ.0.AND S2 121
     1.M11.LE.0)))))) GO TO 126                                         S2 122
C***  COMPUTE DEVIATIONS FOR TIME HISTORIES                             S2 123
      TD=TIME(K)-TIME(1)                                                S2 124
      DO 23 I=1,K                                                       S2 125
      TX=TIME(I)-TIME(1)                                                S2 126
      IF (IFS(1).NE.0) GO TO 14                                         S2 127
      F1(I)=D(I,1)-(D(1,1)+(D(K,1)-D(1,1))/TD*TX)                       S2 128
   14 IF (IFS(2).NE.0) GO TO 15                                         S2 129
      F2(I)=D(I,2)-(D(1,2)+(D(K,2)-D(1,2))/TD*TX)                       S2 130
   15 IF (IFS(3).NE.0) GO TO 16                                         S2 131
      F3(I)=D(I,3)-(D(1,3)+(D(K,3)-D(1,3))/TD*TX)                       S2 132
   16 IF (IFS(4).NE.0) GO TO 17                                         S2 133
      F4(I)=D(I,4)-(D(1,4)+(D(K,4)-D(1,4))/TD*TX)                       S2 134
   17 IF (IFS(5).NE.0) GO TO 18                                         S2 135
      F5(I)=D(I,5)-(D(1,5)+(D(K,5)-D(1,5))/TD*TX)                       S2 136
   18 IF (IFS(6).NE.0) GO TO 19                                         S2 137
      F6(I)=D(I,6)-(D(1,6)+(D(K,6)-D(1,6))/TD*TX)                       S2 138
   19 IF (IFS(7).NE.0) GO TO 20                                         S2 139
      F7(I)=D(I,7)-(D(1,7)+(D(K,7)-D(1,7))/TD*TX)                       S2 140
   20 IF (IFS(9).NE.0) GO TO 21                                         S2 141
      F10(I)=D(I,9)-(D(1,9)+(D(K,9)-D(1,9))/TD*TX)                      S2 142
   21 IF (IFS(10).NE.0) GO TO 22                                        S2 143
      F13(I)=D(I,10)-(D(1,10)+(D(K,10)-D(1,10))/TD*TX)                  S2 144
   22 IF (IFS(11).NE.0) GO TO 23                                        S2 145
      F14(I)=D(I,11)-(D(1,11)+(D(K,11)-D(1,11))/TD*TX)                  S2 146
   23 CONTINUE                                                          S2 147
      IF (IFS(1).NE.0) GO TO 26                                         S2 148
C***  PERFORM FOURIER ANALYSIS ON WEIGHT TIME HISTORY                   S2 149
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      M1P1=M1+1                                                          S2  150
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  151
      CALL FASAP(F1,K,M1P1,MC(1))                                        S2  152
C***  REGENERATE WEIGHT TIME HISTORY (SMOOTHED)                          S2  153
      X1=A(1)                                                            S2  154
      DO 25 L=1,K                                                        S2  155
      TX=TIME(L)-TIME(1)                                                 S2  156
      X2=D(1,1)+(D(K,1)-D(1,1))/TE*TX                                    S2  157
      X3=0.0D0                                                           S2  158
      DO 24 N=2,M1P1                                                     S2  159
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  160
     1)/TT)                                                              S2  161
   24 CONTINUE                                                           S2  162
   25 F1(L)=X1+X2+X3                                                     S2  163
   26 IF (IFS(2).NE.0) GO TO 29                                          S2  164
C***  PERFORM FOURIER ANALYSIS ON PITCH ANGLE TIME HISTORY               S2  165
      M2P1=M2+1                                                          S2  166
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  167
      CALL FASAP(F2,K,M2P1,MC(2))                                        S2  168
C***  REGENERATE PITCH ANGLE TIME HISTORY (SMOOTHED)                     S2  169
      X1=A(1)                                                            S2  170
      DO 28 L=1,K                                                        S2  171
      TX=TIME(L)-TIME(1)                                                 S2  172
      X2=D(1,2)+(D(K,2)-D(1,2))/TE*TX                                    S2  173
      X3=0.0D0                                                           S2  174
      DO 27 N=2,M2P1                                                     S2  175
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  176
     1)/TT)                                                              S2  177
   27 CONTINUE                                                           S2  178
   28 F2(L)=X1+X2+X3                                                     S2  179
   29 IF (IFS(3).NE.0) GO TO 32                                          S2  180
C***  PERFORM FOURIER ANALYSIS ON PITCH RATE TIME HISTORY                S2  181
      M3P1=M3+1                                                          S2  182
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  183
      CALL FASAP(F3,K,M3P1,MC(3))                                        S2  184
C***  REGENERATE PITCH RATE TIME HISTORY (SMOOTHED)                      S2  185
      X1=A(1)                                                            S2  186
      DO 31 L=1,K                                                        S2  187
      TX=TIME(L)-TIME(1)                                                 S2  188
      X2=D(1,3)+(D(K,3)-D(1,3))/TE*TX                                    S2  189
      X3=0.0D0                                                           S2  190
      DO 30 N=2,M3P1                                                     S2  191
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  192
     1)/TT)                                                              S2  193
   30 CONTINUE                                                           S2  194
   31 F3(L)=X1+X2+X3                                                     S2  195
C***  INTEGRATE PITCH RATE TO OBTAIN PITCH ANGLE, IF DESIRED             S2  196
      PA1=F2(1)                                                          S2  197
      IF (IPRC(7).NE.0) CALL TRAP(K,TIME,F3,F2,PA1)                      S2  198
   32 IF (IFS(4).NE.0) GO TO 37                                          S2  199
C***  PERFORM FOURIER ANALYSIS ON AIRSPEED TIME HISTORY                  S2  200
      M4P1=M4+1                                                          S2  201
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  202
      CALL FASAP(F4,K,M4P1,MC(4))                                        S2  203
C***  REGENERATE AIRSPEED TIME HISTORY (SMOOTHED)                        S2  204
      X1=A(1)                                                            S2  205
      DO 34 L=1,K                                                        S2  206
      TX=TIME(L)-TIME(1)                                                 S2  207
      X2=D(1,4)+(D(K,4)-D(1,4))/TD*TX                                    S2  208
      X3=0.0D0                                                           S2  209
      DO 33 N=2,M4P1                                                     S2  210
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  211
     1)/TT)                                                              S2  212
   33 CONTINUE                                                           S2  213
   34 F4(L)=X1+X2+X3                                                     S2  214
      IF (IPRC(1).NE.0) GO TO 37                                         S2  215
C***  COMPUTE ACCELERATION (DERIVATIVE OF AIRSPEED) TIME HISTORY         S2  216
      XD1=(D(K,4)-D(1,4))/TD                                             S2  217
      DO 36 L=1,K                                                        S2  218
      XD2=0.0D0                                                          S2  219
      DO 35 N=1,M4                                                       S2  220
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*TIME(L)/TT)+B(N+1)*DCOS(2*N S2  221
     1*PI*TIME(L)/TT))                                                   S2  222
   35 CONTINUE                                                           S2  223
   36 F8(L)=XD1+XD2                                                      S2  224
C***  CHECK FOR ACCELERATION-INPUT-OPTION COMPATIBILITY                  S2  225
   37 IF (IFS(4).NE.0.AND.IPRC(1).EQ.0)IPRC(1)=1                         S2  226
      IF (IFS(5).NE.0) GO TO 40                                          S2  227
C***  PERFORM FOURIER ANALYSIS ON DENSITY TIME HISTORY                   S2  228
      M5P1=M5+1                                                          S2  229
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  230
      CALL FASAP(F5,K,M5P1,MC(5))                                        S2  231
C***  REGENERATE DENSITY TIME HISTORY (SMOOTHED)                         S2  232
      X1=A(1)                                                            S2  233
      DO 39 L=1,K                                                        S2  234
      TX=TIME(L)-TIME(1)                                                 S2  235
      X2=D(1,5)+(D(K,5)-D(1,5))/TE*TX                                    S2  236
      X3=0.0D0                                                           S2  237
      DO 38 N=2,M5P1                                                     S2  238
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  239
     1)/TT)                                                              S2  240
   38 CONTINUE                                                           S2  241
   39 F5(L)=X1+X2+X3                                                     S2  242
   40 IF (IFS(6).NE.0) GO TO 45                                          S2  243
C***  PERFORM FOURIER ANALYSIS ON ANGLE-OF-ATTACK TIME HISTORY           S2  244
      M6P1=M6+1                                                          S2  245
C***  COMPUTE FOURIER SERIES COEFFICIENTS                                S2  246
      CALL FASAP(F6,K,M6P1,MC(6))                                        S2  247
C***  REGENERATE ANGLE-OF-ATTACK TIME HISTORY (SMOOTHED)                 S2  248
      X1=A(1)                                                            S2  249
      DO 42 L=1,K                                                        S2  250
      TX=TIME(L)-TIME(1)                                                 S2  251
      X2=D(1,6)+(D(K,6)-D(1,6))/TD*TX                                    S2  252
      X3=0.0D0                                                           S2  253
      DO 41 N=2,M6P1                                                     S2  254
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  255
     1)/TT)                                                              S2  256
   41 CONTINUE                                                           S2  257
   42 F6(L)=X1+X2+X3                                                     S2  258
      IF (IPRC(3).NE.0) GO TO 45                                         S2  259
C***  COMPUTE ANGLE-OF-ATTACK RATE TIME HISTORY                          S2  260
      XD1=(D(K,6)-D(1,6))/TD                                             S2  261
      DO 44 L=1,K                                                        S2  262
      XD2=0.0D0                                                          S2  263
      DO 43 N=1,M6                                                       S2  264
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*TIME(L)/TT)+B(N+1)*DCOS(2*N S2  265
     1*PI*TIME(L)/TT))                                                   S2  266
   43 CONTINUE                                                           S2  267
   44 F9(L)=XD1+XD2                                                      S2  268
      IF (IFS(6).EQ.0.AND.IPRC(3).EQ.0) GO TO 47                         S2  269
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   45 IPRC(3)=1                                                          S2  270
      IF (IFS(6).NE.0) WRITE (JWRITE,46)                                 S2  271
   46 FORMAT (1X,////,15X,90HWARNING -> ANGLE-OF-ATTACK DATA HAS COMPUTE S2  272
     1D USING UNSMOOTHED ANGLE-OF-ATTACK TIME HISTORY.////)              S2  273
      CALL FWI(K,F6,TIME,F9,DY,1,NS,NI)                                 S2  274
   47 IF (IFS(7).NE.0) GO TO 50                                         S2  275
C***  PERFORM FOURIER ANALYSIS ON TEMPERATURE TIME HISTORY              S2  276
      M7P1=M7+1                                                         S2  277
C***  COMPUTE FOURIER SERIES COEFFICIENTS                               S2  278
      CALL PARAF(F7,K,M7P1,NC(7))                                       S2  279
C***  REGENERATE TEMPERATURE TIME HISTORY (SMOOTHED)                    S2  280
      X1=A(1)                                                           S2  281
      DO 49 L=1,K                                                       S2  282
      TX=TIME(L)-TIME(1)                                                S2  283
      X2=D(1,7)+(D(K,7)-D(1,7))/TD*TX                                   S2  284
      X3=0.0D0                                                          S2  285
      DO 48 N=2,M7P1                                                    S2  286
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  287
     1)/TT)                                                             S2  288
   48 CONTINUE                                                          S2  289
   49 F7(L)=X1+X2+X3                                                    S2  290
C***  PERFORM FOURIER ANALYSIS ON LONGITUDINAL ACCELERATION TIME HISTORY S2  291
   50 LLX=0                                                             S2  292
      GO TO 53                                                          S2  293
   51 IF (IPRC(2).LT.0.OR.IPRC(2).GE.2) GO TO 60                        S2  294
      IF (IPRC(2).NE.0.AND.IPRC(1).NE.0)IPRC(1)=0                       S2  295
C***  CONVERT LONGITUDINAL ACCELERATION INTO 'COMPATIBLE' ACCELERATION  S2  296
      DO 52 JJ=1,K                                                      S2  297
      D(JJ,8)=(AX(JJ)-G*DSIN(F2(JJ))+XAX*F3(JJ)*F3(JJ))/DCOS(F6(JJ))+F4( S2  298
     1JJ)*(F9(JJ)-F3(JJ))*(DSIN(F6(JJ))/DCOS(F6(JJ)))                   S2  299
      IF (IPRC(8).EQ.0) GO TO 52                                        S2  300
      DY(JJ)=D(JJ,8)                                                    S2  301
      D(JJ,8)=AX(JJ)                                                    S2  302
   52 CONTINUE                                                          S2  303
      IF (IPRC(8).NE.0) GO TO 53                                        S2  304
      IF (IPRC(2).EQ.1) GO TO 60                                        S2  305
C***  COMPUTE DEVIATIONS FOR LONGITUDINAL ACCELERATION                  S2  306
   53 DO 54 I=1,K                                                       S2  307
      TX=TIME(I)-TIME(1)                                                S2  308
   54 FX(I)=D(I,8)-(D(1,8)+(D(K,8)-D(1,8))/TD*TX)                       S2  309
      M8P1=M8+1                                                         S2  310
C***  COMPUTE FOURIER SERIES COEFFICIENTS                               S2  311
      CALL PARAF(FX,K,M8P1,NC(8))                                       S2  312
C***  REGENERATE ACCELERATION TIME HISTORY (SMOOTHED)                   S2  313
      X1=A(1)                                                           S2  314
      DO 56 L=1,K                                                       S2  315
      TX=TIME(L)-TIME(1)                                                S2  316
      X2=D(1,8)+(D(K,8)-D(1,8))/TD*TX                                   S2  317
      X3=0.0D0                                                          S2  318
      DO 55 N=2,M8P1                                                    S2  319
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  320
     1)/TT)                                                             S2  321
   55 CONTINUE                                                          S2  322
      DY(L)=X1+X2+X3                                                    S2  323
      IF (LLX.EQ.0)S7(L,4)=DY(L)                                        S2  324
   56 CONTINUE                                                          S2  325
      IF (LLX.NE.0) GO TO 57                                            S2  326
      LLX=1                                                             S2  327
      GO TO 51                                                          S2  328
   57 DO 59 JJ=1,K                                                      S2  329
      IF (IPRC(8).EQ.0) GO TO 58                                        S2  330
      D(JJ,8)=DY(JJ)                                                    S2  331
      DY(JJ)=DY(JJ)                                                     S2  332
      GO TO 59                                                          S2  333
   58 D(JJ,8)=DY(JJ)                                                    S2  334
   59 CONTINUE                                                          S2  335
C***  ARRANGE FOR CORRECT LISTING                                       S2  336
   60 IF (IPRC(2).EQ.0.AND.IPRC(1).NE.0) GO TO 61                       S2  337
      GO TO 63                                                          S2  338
   61 DO 62 JJ=1,K                                                      S2  339
      F8(JJ)=D(JJ,8)                                                    S2  340
   62 D(JJ,8)=AX(JJ)                                                    S2  341
   63 IF (IPRC(1).NE.0.AND.IPRC(2).EQ.2) GO TO 64                       S2  342
      GO TO 66                                                          S2  343
   64 WRITE (JWRITE,65)                                                 S2  344
   65 FORMAT (1X,///,5X,'THE VALUES OF IPRC(1) AND IPRC(2) ARE NOT COMPA S2  345
     1TIBLE.  RETURNING TO NEXT DATA SET, IF ANY.',////)                S2  346
      IPRC=1                                                            S2  347
      RETURN                                                            S2  348
   66 IF (IFS(9).NE.0) GO TO 71                                         S2  349
C***  PERFORM FOURIER ANALYSIS ON ALTITUDE TIME HISTORY                 S2  350
      M9P1=M9+1                                                         S2  351
C***  COMPUTE FOURIER SERIES COEFFICIENTS                               S2  352
      CALL PARAF(F10,K,M9P1,NC(9))                                      S2  353
C***  REGENERATE ALTITUDE TIME HISTORY (SMOOTHED)                       S2  354
      X1=A(1)                                                           S2  355
      DO 68 L=1,K                                                       S2  356
      TX=TIME(L)-TIME(1)                                                S2  357
      X2=D(1,9)+(D(K,9)-D(1,9))/TD*TX                                   S2  358
      X3=0.0D0                                                          S2  359
      DO 67 N=2,M9P1                                                    S2  360
      X3=X3+A(N)*DCOS(2*(N-1)*PI*TIME(L)/TT)+B(N)*DSIN(2*(N-1)*PI*TIME(L S2  361
     1)/TT)                                                             S2  362
   67 CONTINUE                                                          S2  363
      F10(L)=X1+X2+X3                                                   S2  364
C***  ADJUST DENSITY TO BE COMPATIBLE WITH ALTITUDE                     S2  365
      IF (IFS(5).NE.0) F5(L)=RHO*(1.0D0-6.86D-06*F10(L))**4.26D0        S2  366
   68 CONTINUE                                                          S2  367
C***  COMPUTE DERIVATIVE OF ALTITUDE TIME HISTORY                       S2  368
      XD1=(D(K,9)-D(1,9))/TD                                            S2  369
      DO 70 L=1,K                                                       S2  370
      XD3=0.0D0                                                         S2  371
      XD2=0.0D0                                                         S2  372
      DO 69 N=1,M9                                                      S2  373
      XD2=XD2+2*N*PI/TT*(-A(N+1)*DSIN(2*N*PI*TIME(L)/TT)+B(N+1)*DCOS(2*N S2  374
     1*PI*TIME(L)/TT))                                                  S2  375
      XD3=XD3-(2*N*PI/TT)**2*(A(N+1)*DCOS(2*N*PI*TIME(L)/TT)+B(N+1)*DSIN S2  376
     1(2*N*PI*TIME(L)/TT))                                              S2  377
   69 CONTINUE                                                          S2  378
      F12(L)=XD3                                                        S2  379
   70 F11(L)=XD1+XD2                                                    S2  380
   71 IF (IFS(9).EQ.0) GO TO 73                                         S2  381
      WRITE (JWRITE,72)                                                 S2  382
   72 FORMAT (1X,////,15X,86HWARNING -> ALTITUDE  DERIVATIVES  WERE COMP S2  383
     1UTED USING UNSMOOTHED ALTITUDE TIME HISTORY.////)                 S2  384
      CALL FWI(K,F10,TIME,F11,F12,2,NS,NI)                              S2  385
   73 IF (IPRC(8).EQ.0) GO TO 83                                        S2  386
      IF (IPRC(8).GE.2) GO TO 80                                        S2  387
C***  USING NEWTON-RAPHSON METHOD, FIND COMPATIBLE ANGLE OF ATTACK      S2  388
      ICNT=0                                                            S2  389
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      DO 78 L=1,K                                                       S2  390
      ITB=0                                                             S2  391
      ALP=P6(1)                                                         S2  392
      XP1=G*F11(L)/F4(L)*F8(L)                                          S2  393
      XP2=G*DSQRT(1.0D0-(F11(1)/F4(L))**2)+(F4(L)*F12(L)-F11(L)*F8(L))/(  S2  394
     1F4(L)*DSQRT(1.0D0-(F11(1)/F4(L))**2))                             S2  395
   74 ITB=ITB+1                                                         S2  396
      FN=AX(L)-XP1*DCOS(ALP)-XP2*DSIN(ALP)*XAX*F3(L)*F3(L)              S2  397
      FNP=XP1*DSIN(ALP)-XP2*DCOS(ALP)                                   S2  398
      FNPP=XP1*DCOS(ALP)+XP2*DSIN(ALP)                                  S2  399
      BAC=(FNP/FNPP)*(FNP/FNPP)-2.0D0*(FN/FNPP)                         S2  400
      ALP1=ALP                                                          S2  401
      IF (BAC.LT.0.0D0) GO TO 76                                        S2  402
      IF ((FNP*FNPP).LT.0.0D0) GO TO 75                                 S2  403
      ALP=ALP-FNP/FNPP+DSQRT(BAC)                                       S2  404
      GO TO 77                                                          S2  405
   75 ALP=ALP-FNP/FNPP-DSQRT(BAC)                                       S2  406
      GO TO 77                                                          S2  407
   76 ALP=ALP-FNP/FNPP                                                  S2  408
      LCNT=LCNT+1                                                       S2  409
      GO TC 78                                                          S2  410
   77 IF (DABS(ALP1-ALP).LT.1.0D-15.OR.ITB.EQ.20) GO TO 78              S2  411
      GO TO 74                                                          S2  412
   78 P6(1)=ALP                                                         S2  413
      IF (LCNT.NE.0) WRITE (JWRITE,79) LCNT                             S2  414
   79 FORMAT (1X,///,10X,104H*** USING NEWTON-RAPHSON TO FIND COMPATIBLE S2  415
     1 ANGLE OF ATTACK, THE ROUTINE WISHED TO SEEK  COMPLEX  ROOTS,I3,7H S2  416
     1 TIMES.,//)                                                       S2  417
      GO TO 83                                                          S2  418
C***  FIND COMPATIBLE DERIVATIVE OF FLIGHT-PATH ANGLE                   S2  419
   80 DO 81 L=1,K                                                       S2  420
   81 DX(L)=(AX(L)-G*DSIN(P2(L))+XAX*F3(L)*F3(L)-F8(L)*DCOS(P6(L)))/(P4(  S2  421
     1L)*DSIN(P6(L)))                                                   S2  422
      GO=P2(1)-P6(1)                                                    S2  423
C***  INTEGRATE DERIVATIVE OF FLIGHT-PATH ANGLE                         S2  424
      CALL TRAP(K,TIME,DX,DX,GO)                                        S2  425
C***  COMPUTE ALTITUDE RATE                                             S2  426
      DO 82 L=1,K                                                       S2  427
   82 HD(L)=P4(L)*DSIN(DX(L))                                           S2  428
      HO=P10(1)                                                         S2  429
C***  INTEGRATE ALTITUDE RATE                                           S2  430
      CALL TRAP(K,TIME,HD,H,HO)                                         S2  431
   83 IF (IPRC(9).EQ.0) GC TO 86                                        S2  432
C***  FIND AN INERTIAL-COMPATIBLE ALTITUDE AND DENSITY                  S2  433
      HO=P10(1)                                                         S2  434
      DO 84 L=1,K                                                       S2  435
      CALL SEC4(L,K,XAX)                                                S2  436
   84 DX(L)=P4(L)*DSIN(P2(L)-P6(L))                                     S2  437
      CALL TRAP(K,TIME,DX,DY,HO)                                        S2  438
      DO 85 L=1,K                                                       S2  439
      P10(L)=FAC1*P10(L)+FAC2*DY(L)                                     S2  440
   85 F5(L)=RHO*(1.0D0-6.86D-6*P10(L))**4.26D0                          S2  441
      CALL FMI(K,P10,TIME,F11,F12,2,MS,MI)                              S2  442
   86 IF (IFS(10).NE.0) GC TO 89                                        S2  443
C***  PERFORM FOURIER ANALYSIS ON VERTICAL ACCELERATION                 S2  444
      M10P1=M10+1                                                       S2  445
C***  COMPUTE FOURIER SERIES COEFFICIENTS                               S2  446
      CALL FARAF(F13,K,M10P1,NC(10))                                    S2  447
C***  REGENERATE VERTICAL ACCELERATION TIME HISTORY (SMOOTHED)          S2  448
      X1=A(1)                                                           S2  449
      DO 88 L=1,K                                                       S2  450
      TX=TIME(L)-TIME(1)                                                S2  451
      X2=D(1,10)+(D(K,10)-D(1,10))/TD*TX                                S2  452
      X3=0.0D0                                                          S2  453
      DC 87 M=2,M10P1                                                   S2  454
      X3=X3+A(M)*DCOS(2*(M-1)*PI*TIME(L)/TT)+B(M)*DSIN(2*(M-1)*PI*TIME(L S2  455
     1)/TT)                                                             S2  456
   87 CONTINUE                                                          S2  457
   88 F13(L)=X1+X2+X3                                                   S2  458
   89 IF (IFS(11).NE.0) GO TO 92                                        S2  459
C***  PERFORM FOURIER ANALYSIS ON ELEVATOR (OR STABILATOR) DEFLECTION   S2  460
      M11P1=M11+1                                                       S2  461
C***  COMPUTE FOURIER SERIES COEFFICIENTS                               S2  462
      CALL FARAF(F14,K,M11P1,NC(11))                                    S2  463
C***  REGENERATE (ELEVATOR/STABILATOR) DEFLECTION TIME HISTORY(SMOOTHED) S2  464
      X1=A(1)                                                           S2  465
      DO 91 L=1,K                                                       S2  466
      TX=TIME(L)-TIME(1)                                                S2  467
      X2=D(1,11)+(D(K,11)-D(1,11))/TD*TX                                S2  468
      X3=0.0D0                                                          S2  469
      DO 90 M=2,M11P1                                                   S2  470
      X3=X3+A(M)*DCOS(2*(M-1)*PI*TIME(L)/TT)+B(M)*DSIN(2*(M-1)*PI*TIME(L S2  471
     1)/TT)                                                             S2  472
   90 CONTINUE                                                          S2  473
   91 F14(L)=X1+X2+X3                                                   S2  474
C***  WRITE INPUT PARAMETERS                                            S2  475
   92 IF (JF.NE.1) GO TO 96                                             S2  476
      WRITE (JWRITE,93) IFS(1),NC(1),IP(1),IP(13),IFS(2),NC(2),IP(2),IP( S2  477
     114),IFS(3),NC(3),IP(3),IPRC(1),IFS(4),NC(4),IP(4),IPRC(2),IFS(5),N S2  478
     1C(5),IP(5),IPRC(3),IFS(6),NC(6),IP(6),IPRC(4),IFS(7),NC(7),IP(7),I S2  479
     1PRC(5),IFS(8),NC(8),IP(8),IPRC(6),IFS(9),NC(9),IP(9),IPRC(7),IFS(1 S2  480
     10),NC(10),IP(10),IPRC(8),IFS(11),NC(11),IP(11),IPRC(9),XAX,IP(12)  S2  481
   93 FORMAT (1H1,////,42X,48('*'),/,42X,'*',46X,'*',/,42X,'*',10X,26HSE S2  482
     1CTION 2 INPUT PARAMETERS,10X,'*',/,42X,'*',46X,'*',/,42X,'*',2X,'I S2  483
     1FS(1)=',I2,2X,'NC(1)=',I3,2X,'IP(1)=',I2,2X,'IP(13)=',I2,3X,'*',/, S2  484
     142X,'*',2X,'IFS(2)=',I2,2X,'NC(2)=',I3,2X,'IP(2)=',I2,2X,'IP(14)=' S2  485
     1,I2,3X,'*',/,42X,'*',2X,'IFS(3)=',I2,2X,'NC(3)=',I3,2X,'IP(3)=',I2 S2  486
     1,2X,'IPRC(1)=',I2,2X,'*',/,42X,'*',2X,'IFS(4)=',I2,2X,'NC(4)=',I3, S2  487
     12X,'IP(4)=',I2,2X,'IPRC(2)=',I2,2X,'*',/,42X,'*',2X,'IFS(5)=',I2,2 S2  488
     1X,'NC(5)=',I3,2X,'IP(5)=',I2,2X,'IPRC(3)=',I2,2X,'*',/,42X,'*',2X, S2  489
     1'IFS(6)=',I2,2X,'NC(6)=',I3,2X,'IP(6)=',I2,2X,'IPRC(4)=',I2,2X,'*' S2  490
     1,/,42X,'*',2X,'IFS(7)=',I2,2X,'NC(7)=',I3,2X,'IP(7)=',I2,2X,'IPRC( S2  491
     115)=',I2,2X,'*',/,42X,'*',2X,'IFS(8)=',I2,2X,'NC(8)=',I3,2X,'IP(8)= S2  492
     1',I2,2X,'IPRC(6)=',I2,2X,'*',/,42X,'*',2X,'IFS(9)=',I2,2X,'NC(9)=' S2  493
     1,I3,2X,'IP(9)=',I2,2X,'IPRC(7)=',I2,2X,'*',/,42X,'*',2X,'IFS(10)=' S2  494
     1,I1,2X,'NC(10)=',I2,2X,'IP(10)=',I1,2X,'IPRC(8)=',I2,2X,'*',/,42X, S2  495
     1'*',2X,'IFS(11)=',I1,2X,'NC(11)=',I2,2X,'IP(11)=',I1,2X,'IPRC(9)=' S2  496
     1,I2,2X,'*',/,42X,'*',2X,'XAX=',F12.8,6X,'IP(12)=',I1,14X,'*',/,46X S2  497
     1,6('*'),'*',46X,'*',6('*'),/,36X,'*',50X,'*')                     S2  498
      WRITE (JWRITE,94) (I,AP(I),I,W(I),I=1,6)                          S2  499
   94 FORMAT (36X,'* AP(',I1,')=',1PD19.12,7X,'W(',I1,')=',1PD19.12,' *' S2  500
     1)                                                                 S2  501
      WRITE (JWRITE,95)                                                 S2  502
   95 FORMAT (36X,'*',58('*'),'*',///)                                  S2  503
C***  TEMPORARILY STORE VALUES                                          S2  504
   96 DO 97 I=1,K                                                       S2  505
      TST(I,1)=D(I,1)                                                   S2  506
      TST(I,2)=F2(I)                                                    S2  507
      TST(I,3)=D(I,2)                                                   S2  508
      TST(I,4)=F3(I)                                                    S2  509
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      TST(I,5)=D(I,3)                                                   S2  510
      TST(I,6)=ST(I,3)                                                  S2  511
      TST(I,7)=P4(I)                                                    S2  512
      TST(I,8)=ST(I,2)                                                  S2  513
      TST(I,9)=P6(I)                                                    S2  514
      TST(I,10)=D(I,6)                                                  S2  515
      TST(I,11)=P9(I)                                                   S2  516
      TST(I,12)=ST(I,1)                                                 S2  517
      TST(I,13)=ST(I,4)                                                 S2  518
      TST(I,14)=P8(I)                                                   S2  519
      TST(I,15)=P13(I)                                                  S2  520
      TST(I,16)=P14(I)                                                  S2  521
   97 CONTINUE                                                          S2  522
      KS=K                                                              S2  523
C***  EXACT MINIMIZATION TECHNIQUE                                      S2  524
      CALL SEC3(K,XAX,LSP,ITEST,JE,NUM,DSPS)                           S2  525
      IF (IERR.NE.0) RETURN                                             S2  526
      IF (ITEST.EQ.0) GO TO 99                                          S2  527
C***  REDEFINE PARAMETERS TO PREVIOUS ITERATIONS                        S2  528
      K=KS                                                              S2  529
      DO 98 I=1,K                                                       S2  530
      D(I,1)=TST(I,1)                                                   S2  531
      P2(I)=TST(I,2)                                                    S2  532
      D(I,2)=TST(I,3)                                                   S2  533
      P3(I)=TST(I,4)                                                    S2  534
      D(I,3)=TST(I,5)                                                   S2  535
      D(I,4)=TST(I,6)                                                   S2  536
      P4(I)=TST(I,7)                                                    S2  537
      D(I,5)=TST(I,8)                                                   S2  538
      P6(I)=TST(I,9)                                                    S2  539
      D(I,6)=TST(I,10)                                                  S2  540
      P9(I)=TST(I,11)                                                   S2  541
      D(I,8)=TST(I,13)                                                  S2  542
      P8(I)=TST(I,14)                                                   S2  543
      P13(I)=TST(I,15)                                                  S2  544
      P14(I)=TST(I,16)                                                  S2  545
   98 CONTINUE                                                          S2  546
   99 IF (JP.NE.NUM.AND.ITEST.EQ.0) GO TO 125                           S2  547
C***  CHECK FOR OVERALL PLOT OPTION                                     S2  548
      IF (IPRC(5).NE.0) GO TO 102                                       S2  549
C***  RESET WITH INITIAL DATA                                           S2  550
      DO 100 I=1,K                                                      S2  551
      DO 100 J=1,11                                                     S2  552
  100 D(I,J)=SS(I,J)                                                    S2  553
      JKS=1                                                             S2  554
C***  DEFINE PLOT CODES                                                 S2  555
C***  WARNING-- WARNING-- THE FOLLOWING PLOTTING ROUTINES MAY NOT BE    S2  556
C***  COMPATIBLE FOR OTHER INSTALLATIONS.  THE USER SHOULD INQUIRE AT   S2  557
C***  HIS INSTALLATION'S PROGRAMMING SERVICES.                          S2  558
C***  COMPUTE TIME SPACING FOR PLOTTING                                 S2  559
      TORG=TIME(K)                                                      S2  560
      DO 101 I=2,21                                                     S2  561
      IF (TORG.GT.TRG(I-1).AND.TORG.LE.TRG(I)) TPTP=TRG(I)              S2  562
      IF (TORG.EQ.TRG(I-1)) TPTP=TRG(I-1)                               S2  563
  101 CONTINUE                                                          S2  564
      CALL PLOTIT(K,TPTP,IP,IPS,IERC,H,HD,XAX)                          S2  565
  102 IF (RETRIC.NE.0) GO TO 113                                        S2  566
C***  WRITE RESULTS IN ENGLISH UNITS                                    S2  567
      WRITE (JWRITE,103)                                                S2  568
  103 FORMAT (1X,///,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',8X,48HFOURIE S2  569
     1R SERIES ANALYSIS WITH SPECIFIED HARMONICS,10X,'*',/,31X,'*',66X,' S2  570
     1*',/,31X,68('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19 S2  571
     1X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8 S2  572
     1X,'|',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE S2  573
     1,5X,'|',5X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',7 S2  574
     1X,5H(LBF),7X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'|',5 S2  575
     1X,8H(FT/SEC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X,' S2  576
     1|',19X,'*',/,6X,'*',119('-'),'*')                                 S2  577
      DO 104 I=1,K                                                      S2  578
  104 WRITE (JWRITE,105) I,TIME(I),P1(I),P2(I),P3(I),P4(I)              S2  579
  105 FORMAT (6X,'*',7X,I3,9X,'|',6X,F7.3,6X,'|',5X,F9.3,5X,'|',3X,F11.7 S2  580
     1,5X,'|',4X,F10.7,5X,'|',5X,F8.4,6X,'*')                           S2  581
      WRITE (JWRITE,106)                                                S2  582
  106 FORMAT (6X,'*',119X,'*',/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X S2  583
     1,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4 S2  584
     1HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',4X,1 S2  585
     1IHTEMPERATURE,4X,'|',3X,12HACCELERATION,4X,'*',/,6X,'*',19X,'|',6X S2  586
     1,6H(SECS),7X,'|',3X,12H(SLUG/FT**3),4X,'|',4X,9H(RADIANS),6X,'|',6 S2  587
     1X,7H(DEG-R),6X,'|',4X,11H(FT/SEC**2),4X,'*',/,6X,'*',19X,'|',19X,' S2  588
     1|',19X,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',119('-'),'*')         S2  589
      DO 107 I=1,K                                                      S2  590
  107 WRITE (JWRITE,108) I,TIME(I),P5(I),P6(I),P7(I),P8(I)              S2  591
  108 FORMAT (6X,'*',7X,I3,5X,'|',6X,F7.3,6X,'|',4X,F10.8,5X,'|',4X,F11. S2  592
     17,4X,'|',7X,F6.2,6X,'|',4X,F9.5,6X,'*')                           S2  593
      WRITE (JWRITE,109)                                                S2  594
  109 FORMAT (6X,'*',119X,'*',/,6X,121('*'))                            S2  595
      WRITE (JWRITE,110)                                                S2  596
  110 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X S2  597
     1,'|',16X,'*',/,6X,'*',1X,10HDATA POINT,1X,'|',3X,4HTIME,3X,'|',1X, S2  598
     120HANGLE-OF-ATTACK RATE,1X,'|',1X,8HALTITUDE,1X,'|',1X,13HALTITUDE S2  599
     1 RATE,1X,'|',1X,11HALT. ACCEL.,1X,'|',1X,12HVERT. ACCEL.,1X,'|',1X S2  600
     1,14HELEV. DEFLECT.,1X,'*',/,6X,'*',12X,'|',2X,6H(SECS),2X,'|',5X,1 S2  601
     12H(RADIAN/SEC),5X,'|',3X,4H(FT),3X,'|',4X,8H(FT/SEC),3X,'|',1X,11H S2  602
     1(FT/SEC**2),1X,'|',2X,11H(FT/SEC**2),1X,'|',3X,9H(RADIANS),4X,'*', S2  603
     1/,6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X,'|',1 S2  604
     16X,'*',/,6X,'*',119('-'),'*')                                     S2  605
      WRITE (JWRITE,111) (I,TIME(I),P9(I),P10(I),P11(I),P12(I),P13(I),P1 S2  606
     14(I),I=1,K1)                                                      S2  607
  111 FORMAT (6X,'*',4X,I4,4X,'|',2X,F6.3,2X,'|',5X,F12.9,5X,'|',1X,F8.2 S2  608
     1,1X,'|',4X,F7.2,4X,'|',2X,F8.2,3X,'|',4X,F6.2,4X,'|',4X,F8.5,4X,'* S2  609
     1')                                                                S2  610
      WRITE (JWRITE,112)                                                S2  611
  112 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X S2  612
     1,'|',16X,'*',/,6X,121('*'))                                       S2  613
      GO TO 120                                                         S2  614
C***  WRITE RESULTS IN SI UNITS                                         S2  615
  113 WRITE (JWRITE,114)                                                S2  616
  114 FORMAT (1X,///,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',8X,48HFOURIE S2  617
     1R SERIES ANALYSIS WITH SPECIFIED HARMONICS,10X,'*',/,31X,'*',66X,' S2  618
     1*',/,31X,68('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19 S2  619
     1X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8 S2  620
     1X,'|',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE S2  621
     1,5X,'|',5X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',5 S2  622
     1X,9H(NEWTONS),5X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,' S2  623
     1|',6X,7H(M/SEC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19 S2  624
     1X,'|',19X,'*',/,6X,'*',119('-'),'*')                              S2  625
      DO 115 I=1,K                                                      S2  626
      WS=P1(I)*4.4482D0                                                 S2  627
      VS=P4(I)*0.3C48D0                                                 S2  628
  115 WRITE (JWRITE,105) I,TIME(I),WS,P2(I),P3(I),VS                    S2  629
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      WRITE (JWRITE,116)                                                S2  630
  116 FORMAT (6X,'*',119X,'*',/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X S2  631
     1,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4 S2  632
     2HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',8X,1 S2  633
     3HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',8X,1 S2  634
     4HTEMPERATURE,4X,'|',3X,12HACCELERATION,4X,'*',/,6X,'*',19X,'|',6X S2  635
     5,6H(SECS),7X,'|',4X,9H(KG/M**3),6X,'|',4X,9H(RADIANS),6X,'|',6X,7H S2  636
     6(DEG-K),6X,'|',4X,10H(M/SEC**2),5X,'*',/,6X,'*',19X,'|',19X,'|',19 S2  637
     7X,'|',19X,'|',19X,'|',15X,'*',/,6X,'*',119('-'),'*')              S2  638
      DO 117 I=1,K                                                      S2  639
      DS=P5(I)*515.38D0                                                 S2  640
      AS=P8(I)*0.3048D0                                                 S2  641
      TK=P7(I)*0.5555556D0                                              S2  642
  117 WRITE (JWRITE,108) I,TIME(I),DS,P6(I),TK,AS                       S2  643
      WRITE (JWRITE,109)                                                S2  644
      WRITE (JWRITE,119)                                                S2  645
  118 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X S2  646
     1,'|',16X,'*',/,6X,'*',1X,10HDATA POINT,1X,'|',3X,4HTIME,3X,'|',1X, S2  647
     220HANGLE-OF-ATTACK RATE,1X,'|',1X,8HALTITUDE,1X,'|',1X,13HALTITUDE S2  648
     3 RATE,1X,'|',1X,11HALT. ACCEL.,1X,'|',1X,12HVERT. ACCEL.,1X,'|',1X S2  649
     4,14HELEV. DEFLECT.,1X,'*',/,6X,'*',12X,'|',2X,6H(SECS),2X,'|',5X,1 S2  650
     512H(RADIAN/SEC),5X,'|',1X,8H(METERS),1X,'|',4X,7H(M/SEC),4X,'|',2X, S2  651
     610H(M/SEC**2),1X,'|',2X,10H(M/SEC**2),2X,'|',3X,9H(RADIANS),4X,'*' S2  652
     7,/,6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X,'|', S2  653
     816X,'*',/,6X,'*',119('-'),'*')                                    S2  654
      DO 119 I=1,K                                                      S2  655
      MS=P10(I)*0.3048D0                                                S2  656
      MDS=P11(I)*0.3048D0                                               S2  657
      MDDS=P12(I)*0.3048D0                                              S2  658
      AZS=P13(I)*0.3048D0                                               S2  659
  119 WRITE (JWRITE,111) I,TIME(I),F9(I),MS,MDS,MDDS,AZS,P14(I)         S2  660
      WRITE (JWRITE,112)                                                S2  661
C***  PUNCH RESULTS                                                     S2  662
      IF (IPRC(6).NE.0) GO TO 125                                       S2  663
      WRITE (JPUNCH,121) (TITLE(I),I=1,20)                              S2  664
  121 FORMAT (20A4)                                                     S2  665
      WRITE (JPUNCH,122) K,S,RHO,G,TT                                   S2  666
  122 FORMAT (4X10,4D15.8)                                              S2  667
      DO 123 I=1,K                                                      S2  668
  123 WRITE (JPUNCH,124) TIME(I),F1(I),F2(I),F3(I),F4(I),F5(I),F6(I),F7( S2  669
     1I),F8(I),F9(I),F10(I),F11(I),F12(I),F13(I),P14(I)                 S2  670
  124 FORMAT (3D25.16/3D25.16/3D25.16/3D25.16/3D25.16)                  S2  671
C***  TRANSFER TO READ NEW DATA CR TO CONTINUE LOOP                     S2  672
  125 RETURN                                                            S2  673
C***  ERROR IDENTIFICATION MESSAGE                                      S2  674
  126 WRITE (JWRITE,127)                                                S2  675
  127 FORMAT (1X,///,20X,'THE SPECIFICATION OF IFS(?) TO NC(?) IS INCORR S2  676
     1ECT.  PROCEEDING WITH NEXT DATA SET, IF ANY.')                    S2  677
      IERR=1                                                            S2  678
      RETURN                                                            S2  679
      END
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      SUBROUTINE PLOTIT(K,TPTX,IP,IFS,IPRC,H,HD,XAX)                    PL    1
C                                                                       PL    2
C***  SUBROUTINE PLOTIT PLOTS TIME HISTORIES                            PL    3
C                                                                       PL    4
      IMPLICIT REAL*8(A-H,O-Z)                                          PL    5
      DIMENSION KD(5),IP(14),IFS(11),IPRC(9),H(450),HD(450)             PL    6
      COMMON TITLE(20),D(45C,11),TIME(450),A(100),B(100),P1(450),P2(450) PL    7
     1,P3(450),P4(450),P5(450),P6(450),P7(450),P8(450),TT,RHO,PI,G,JKS,R PL    8
     2ETRIC,JREAD,JWRITE,JPUNCH,IERR                                    PL    9
      COMMON /CASBY/P11(450),P12(450)                                   PL   10
      COMMON /TEMP1/ST(450,4),PAR(6),PSL,TSL,IPAR                       PL   11
      COMMON /TEMP2/P9(450),P10(450),P13(450),P14(450),AP(6),M(6)       PL   12
      REAL*4 XRD(4,450),XD(4,450),YRD(4,450),YD(4,450),IPTP             PL   13
C                                                                       PL   14
      IPTP=IPTX                                                         PL   15
      DO 1 I=1,K                                                        PL   16
      IF (I.LE.5) KD(I)=-1                                              PL   17
      DO 1 J=1,4                                                        PL   18
    1 XRD(J,I)=TIME(I)                                                  PL   19
C***  PLOT WEIGHT TIME HISTORY                                          PL   20
      IF (IP(1).NE.0) GO TO 4                                           PL   21
      N=1                                                               PL   22
      IF (IFS(1).EQ.0) N=2                                              PL   23
      DO 2 I=1,K                                                        PL   24
      YRD(1,I)=D(I,1)                                                   PL   25
      IF (IFS(1).EQ.0) YRD(2,I)=F1(I)                                   PL   26
      IF (METRIC.NE.0) YRD(1,I)=YRD(1,I)*4.448200/100.0D0               PL   27
    2 IF (METRIC.NE.0.AND.IFS(1).EQ.0) YRD(2,I)=YRD(2,I)*4.448200/100.0D0 PL   28
      CALL PICSIZ(10.0,10.0)                                            PL   29
      IF (METRIC.NE.0) GO TO 3                                          PL   30
      CALL GRAPF(0.0,0.0,TPTP,5.0,1,'TIME(SECS) ',XRD,XD,5.5,3500.0,4500 PL   31
     1,0,250.0,1,'WEIGHT(LBF) ',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' ')    PL   32
      GO TO 4                                                           PL   33
    3 CALL GRAPF(0.0,0.0,TPTP,5.0,1,'TIME(SECS) ',XRD,XD,5.5,150.0,200.0 PL   34
     1,5.0,1,'WEIGHT(NEWTONS)/100 ',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' ' PL   35
     2)                                                                 PL   36
C***  PLOT PITCH ANGLE TIME HISTORY                                     PL   37
    4 IF (IP(2).NE.0) GO TO 6                                           PL   38
      N=1                                                               PL   39
      IF (IFS(2).EQ.0) N=2                                              PL   40
      DO 5 I=1,K                                                        PL   41
      YRD(1,I)=D(I,2)*100.0D0                                           PL   42
    5 IF (IFS(2).EQ.0) YRD(2,I)=P2(I)*100.0D0                           PL   43
      CALL PICSIZ(10.0,10.0)                                            PL   44
      CALL GRAPF(8.0,0.0,TPTP,5.0,1,'TIME(SECS) ',XRD,XD,5.5,-80.0,80.0, PL   45
     1 10.0,1,'PITCH ANGLE(RADIAN) X 100_',YRD,YD,1,4,N,450,K,K,K,K,0,KD, PL   46
     2 1,' ')                                                           PL   47
C***  PLOT PITCH RATE TIME HISTORY                                      PL   48
    6 IF (IP(3).NE.0) GO TO 8                                           PL   49
      N=1                                                               PL   50
      IF (IFS(3).EQ.0) N=2                                              PL   51
      DO 7 I=1,K                                                        PL   52
      YRD(1,I)=D(I,3)*100.0D0                                           PL   53
    7 IF (IFS(3).EQ.0) YRD(2,I)=P3(I)*100.0D0                           PL   54
      CALL PICSIZ(10.0,10.0)                                            PL   55
      CALL GRAPF(8.0,0.0,TPTP,5.0,1,'TIME(SECS) ',XRD,XD,5.5,-80.0,80.0, PL   56
     1 10.0,1,'PITCH RATE(RAD/SEC) X 100_',YRD,YD,1,4,N,450,K,K,K,K,0,KD, PL   57
     2 1,' ')                                                           PL   58
C***  PLOT AIRSPEED TIME HISTORY                                        PL   59
    8 IF (IP(4).NE.0) GO TO 11                                          PL   60
      N=1                                                               PL   61
      IF (IFS(4).EQ.0) N=2                                              PL   62
      DO 9 I=1,K                                                        PL   63
      YRD(1,I)=D(I,4)                                                   PL   64
      IF (IFS(4).EQ.0) YRD(2,I)=P4(I)                                   PL   65
      IF (METRIC.NE.0) YRD(1,I)=YRD(1,I)*0.3048D0                       PL   66
    9 IF (METRIC.NE.0.AND.IFS(4).EQ.0) YRD(2,I)=YRD(2,I)*0.3048D0       PL   67
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      CALL PICSIZ(10.0,10.0)                                                    PL   68
       IF (METRIC.NE.0) GO TO 10                                                PL   69
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,80.0,300.0,       PL   70
      120.0,1,'AIRSPEED(FT/SEC)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _')        PL   71
       GO TO 11                                                                 PL   72
   10 CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,25.0,100.0,       PL   73
      15.0,1,'AIRSPEED(M/SEC)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _')         PL   74
C***  PLOT DENSITY TIME HISTORY                                                 PL   75
   11 IF (IP(5).NE.0) GO TO 14                                                  PL   76
       N=1                                                                      PL   77
       IF (IPS(5).EQ.0) N=2                                                     PL   78
       DO 12 I=1,K                                                              PL   79
       YRD(1,I)=D(I,5)*10000.0D0                                                PL   80
       IF (IPS(5).EQ.0) YRD(2,I)=F5(I)*10000.0D0                                PL   81
       IF (METRIC.NE.0) YRD(1,I)=D(I,5)*5153.8D0                                PL   82
   12 IF (METRIC.NE.0.AND.IPS(5).EQ.0) YRD(2,I)=F5(I)*5153.8D0                  PL   83
       CALL PICSIZ(10.0,10.0)                                                   PL   84
       IF (METRIC.NE.0) GO TO 13                                                PL   85
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,14.0,26.0,2       PL   86
      1.0,1,'DENSITY(SLUG/FT**3) X 10000_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,      PL   87
      1,' _')                                                                   PL   88
       GO TO 14                                                                 PL   89
   13 CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,6.0,12.0,1.       PL   90
      10,1,'DENSITY(KG/M**3) X 10_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _')      PL   91
C***  PLOT ANGLE OF ATTACK TIME HISTORY                                         PL   92
   14 IF (IP(6).NE.0) GO TO 16                                                  PL   93
       N=1                                                                      PL   94
       IF (IPS(6).EQ.0) N=2                                                     PL   95
       DO 15 I=1,K                                                              PL   96
       YRD(1,I)=D(I,6)*100.0D0                                                  PL   97
   15 IF (IPS(6).EQ.0) YRD(2,I)=F6(I)*100.0D0                                   PL   98
       CALL PICSIZ(10.0,10.0)                                                   PL   99
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-5.0,40.0,5       PL  100
      1.0,1,'ANGLE OF ATTACK(RAD) X 100_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1      PL  101
      1,' _')                                                                   PL  102
C***  PLOT TEMPERATURE TIME HISTORY                                             PL  103
   16 IF (IP(7).NE.0) GO TO 19                                                  PL  104
       N=1                                                                      PL  105
       IF (IPS(7).EQ.0) N=2                                                     PL  106
       DO 17 I=1,K                                                              PL  107
       YRD(1,I)=D(I,7)                                                          PL  108
       IF (IPS(7).EQ.0) YRD(2,I)=F7(I)                                          PL  109
       IF (METRIC.NE.0) YRD(1,I)=5.0/9.0*(D(I,7)-491.72D0)+273.16D0             PL  110
   17 IF (METRIC.NE.0.AND.IPS(7).EQ.0) YRD(2,I)=5.0/9.0*(F7(I)-491.72)+27       PL  111
      13.16D0                                                                   PL  112
       CALL PICSIZ(10.0,10.0)                                                   PL  113
       IF (METRIC.NE.0) GO TO 18                                                PL  114
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,450.0,550.0       PL  115
      1,25.0,1,'TEMPERATURE(DEG-R)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _'      PL  116
      1)                                                                        PL  117
       GO TO 19                                                                 PL  118
   18 CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,250.0,300.0       PL  119
      1,10.0,1,'TEMPERATURE(DEG-R)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _'      PL  120
      1)                                                                        PL  121
C***  PLOT ACCELERATION TIME HISTORY                                            PL  122
   19 IF (IP(8).NE.0) GO TO 22                                                  PL  123
       N=2                                                                      PL  124
       IF (IPS(8).EQ.0) N=3                                                     PL  125
       DO 20 I=1,K                                                              PL  126
       YRD(1,I)=D(I,8)                                                          PL  127
       YRD(2,I)=F8(I)*DCOS(F6(I))+F4(I)*(F3(I)-F9(I))*DSIN(F6(I))-XMI*F3(       PL  128
      1I)**2*G*DSIN(P2(I))+PAR(4)*(G*DCOS(P2(I))*F4(I)*(F3(I)-F9(I))*DCOS       PL  129
      1(F6(I))-F8(I)*DSIN(F6(I)))-XMI*G*DCOS(P2(I))*F3(I)-PAR(6)*(F4(I)*        PL  130
      1(F3(I)-F9(I))*DCOS(F6(I))-F8(I)*DSIN(F6(I)))                             PL  131
       IF (IPS(8).EQ.0) YRD(3,I)=F8(I)                                          PL  132
       IF (METRIC.EQ.0) GO TO 20                                                PL  133
       YRD(1,I)=YRD(1,I)*0.3048D0                                               PL  134
       YRD(2,I)=YRD(2,I)*0.3048D0                                               PL  135
       IF (IPS(8).EQ.0) YRD(3,I)=YRD(3,I)*0.3048D0                              PL  136
   20 CONTINUE                                                                  PL  137
       CALL PICSIZ(10.0,10.0)                                                   PL  138
       IF (METRIC.NE.0) GO TO 21                                                PL  139
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-32.0,32.0,       PL  140
      14.0,1,'ACCELERATION(FT/SEC**2)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,'      PL  141
      1 _')                                                                     PL  142
       GO TO 22                                                                 PL  143
   21 CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0,       PL  144
      11.0,1,'ACCELERATION(M/SEC**2)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,'       PL  145
      1 _')                                                                     PL  146
C***  PLOT ANGLE-OF-ATTACK RATE TIME HISTORY                                    PL  147
   22 IF (IP(9).NE.0) GO TO 24                                                  PL  148
       N=1                                                                      PL  149
       DO 23 I=1,K                                                              PL  150
   23 YRD(1,I)=P9(I)*100.0D0                                                    PL  151
       CALL PICSIZ(10.0,10.0)                                                   PL  152
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0,       PL  153
      11.0,1,'ANGLE-OF-ATTACK RATE(RAD/SEC) X 100_',YRD,YD,1,4,N,450,K,K,       PL  154
      1K,K,0,KD,1,' _')                                                         PL  155
C***  PLOT ALTITUDE TIME HISTORY                                                PL  156
   24 IF (IP(10).NE.0) GO TO 30                                                 PL  157
       N=1                                                                      PL  158
       IF ((IPS(9).NE.0.AND.((IPRC(8).GE.2.AND.IPRC(9).EQ.0).OR.(IPRC(8).       PL  159
      1LT.2.AND.IPRC(9).NE.0))).OR.(IPS(9).EQ.0.AND.(IPRC(8).LT.2.AND.IPR       PL  160
      1C(9).EQ.0))) N=2                                                         PL  161
       IF ((IPS(9).NE.0.AND.(IPRC(8).GE.2.AND.IPRC(9).NE.0)).OR.(IPS(9).E       PL  162
      1Q.0.AND.(IPRC(8).GE.2.AND.IPRC(9).EQ.0)).OR.(IPS(9).EQ.0.AND.(IPRC       PL  163
      1(8).LT.2.AND.IPRC(9).NE.0))) N=3                                         PL  164
       IF (IPS(9).EQ.0.AND.(IPRC(8).GE.2.AND.IPRC(9).NE.0)) N=4                 PL  165
       DO 28 I=1,K                                                              PL  166
       YRD(1,I)=D(I,9)/1000.0D0                                                 PL  167
       IF (IPS(9).EQ.0) GO TO 25                                                PL  168
       IF (IPRC(8).GE.2) YRD(2,I)=H(I)/1000.0D0                                 PL  169
       IF (IPRC(8).GE.2.AND.IPRC(9).NE.0) YRD(3,I)=P10(I)/1000.0D0              PL  170
       IF (IPRC(8).LT.2) YRD(2,I)=P10(I)/1000.0D0                               PL  171
       GO TO 26                                                                 PL  172
   25 YRD(2,I)=P10(I)/1000.0D0                                                  PL  173
       IF (IPRC(8).GE.2) YRD(3,I)=H(I)/1000.0D0                                 PL  174
       IF (IPRC(8).GE.2.AND.IPRC(9).NE.0) YRD(4,I)=P10(I)/1000.0D0              PL  175
       IF (IPRC(8).LT.2.AND.IPRC(9).NE.0) YRD(3,I)=P10(I)/1000.0D0              PL  176
   26 IF (METRIC.EQ.0) GO TO 28                                                 PL  177
       DO 27 J=1,N                                                              PL  178
   27 YRD(J,I)=YRD(J,I)*0.3048D0*10.0D0                                         PL  179
   28 CONTINUE                                                                  PL  180
       CALL PICSIZ(10.0,10.0)                                                   PL  181
       IF (METRIC.NE.0) GO TO 29                                                PL  182
       CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,2.0,16.0,1.       PL  183
      10,1,'ALTITUDE(FT)/1000_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _')          PL  184
       GO TO 30                                                                 PL  185
   29 CALL GRAPF(8.0,0.0,TPIP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,0.0,48.0,2.       PL  186
      10,1,'ALTITUDE(M)/100 _',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _')           PL  187
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C***  PLOT ALTITUDE RATE TIME HISTORY                                    PL  188
   30 IF (IP(11).NE.0) GO TO 34                                          PL  189
      N=2                                                                PL  190
      IF (IPRC(8).GE.2)N=3                                               PL  191
      DO 32 I=1,K                                                        PL  192
      YRD(1,I)=F11(I)                                                    PL  193
      YRD(2,I)=-F4(I)*F8(I)/G                                            PL  194
      IF (IPRC(8).GE.2)YRD(3,I)=HD(I)                                    PL  195
      IF (METRIC.EQ.0) GO TO 32                                          PL  196
      DO 31 J=1,N                                                        PL  197
   31 YRD(J,I)=YRD(J,I)*0.3048D0                                         PL  198
   32 CONTINUE                                                           PL  199
      CALL PICSIZ(10.0,10.0)                                             PL  200
      IF (METRIC.NE.0) GO TO 33                                          PL  201
      CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-100.0,100. PL  202
     10,10.0,1,'ALTITUDE RATE(FT/SEC)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1, PL  203
     1' _')                                                              PL  204
      GO TO 34                                                           PL  205
   33 CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-34.0,34.0, PL  206
     14.0,1,'ALTITUDE RATE(M/SEC)_',YRD,YD,1,4,N,450,K,K,K,K,0,KD,1,' _' PL  207
     1)                                                                  PL  208
C***  PLOT ALTITUDE ACCELERATION TIME HISTORY                            PL  209
   34 IF (IP(12).NE.0) GO TO 37                                          PL  210
      DO 35 I=1,K                                                        PL  211
      YRD(1,I)=F12(I)                                                    PL  212
   35 IF (METRIC.NE.0)YRD(1,I)=F12(I)*0.3048D0                           PL  213
      CALL PICSIZ(10.0,10.0)                                             PL  214
      IF (METRIC.NE.0) GO TO 36                                          PL  215
      CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-100.0,100. PL  216
     10,10.0,1,'ALTITUDE ACCELERATION(FT/SEC**2)_',YRD,YD,1,4,1,450,K,K, PL  217
     1K,K,0,KD,1,' _')                                                   PL  218
      GO TO 37                                                           PL  219
   36 CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-34.0,34.0, PL  220
     14.0,1,'ALTITUDE ACCELERATION(M/SEC**2)_',YRD,YD,1,4,1,450,K,K,K,K, PL  221
     10,KD,1,' _')                                                       PL  222
C***  PLOT VERTICAL ACCELERATION TIME HISTORY                            PL  223
   37 IF (IP(13).NE.0) GO TO 41                                          PL  224
      N=1                                                                PL  225
      IF (IFS(10).EQ.0)N=2                                               PL  226
      DO 39 I=1,K                                                        PL  227
      YRD(1,I)=D(I,10)                                                   PL  228
      IF (IFS(10).EQ.0)YRD(2,I)=F13(I)                                   PL  229
      IF (METRIC.EQ.0) GO TO 39                                          PL  230
      DO 38 J=1,N                                                        PL  231
   38 YRD(J,I)=YRD(J,I)*0.3048D0                                         PL  232
   39 CONTINUE                                                           PL  233
      CALL PICSIZ(10.0,10.0)                                             PL  234
      IF (METRIC.NE.0) GO TO 40                                          PL  235
      CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-32.0,32.0, PL  236
     14.0,1,'VERTICAL ACCELERATION(FT/SEC**2)_',YRD,YD,1,4,N,450,K,K,K,K PL  237
     1,0,KE,1,' _')                                                      PL  238
      GO TO 41                                                           PL  239
   40 CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0, PL  240
     12.0,1,'VERTICAL ACCELERATION(M/SEC**2)_',YRD,YD,1,4,N,450,K,K,K,K, PL  241
     10,KE,1,' _')                                                       PL  242
C***  PLOT ELEVATOR DEFLECTION TIME HISTORY                              PL  243
   41 IF (IP(14).NE.0) GO TO 43                                          PL  244
      N=1                                                                PL  245
      IF (IFS(11).EQ.0)N=2                                               PL  246
      DO 42 I=1,K                                                        PL  247
      YRD(1,I)=D(I,11)*100.0D0                                           PL  248
   42 IF (IFS(11).EQ.0)YRD(2,I)=F14(I)*100.0D0                           PL  249
      CALL PICSIZ(10.0,10.0)                                             PL  250
      CALL GRAPF(8.0,0.0,TP1P,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-25.0,25.0, PL  251
     15.0,1,'ELEVATOR DEFLECTION(RAD) X 100_',YRD,YD,1,4,N,450,K,K,K,K,0 PL  252
     1,KD,1,' _')                                                        PL  253
   43 RETURN                                                             PL  254
      END                                                                PL  255


      SUBROUTINE SEC3(K,XAX,LSP,ITEST,LL,NUM,DSPS)                       S3    1
C                                                                        S3    2
C***  SUBROUTINE SEC3 CALCULATES BIASES, PHASE SHIFT, AND OTHER DATA-    S3    3
C***  DEPENDENT PARAMETERS BY A MINIMIZATION TECHNIQUE AND ADJUSTS THE   S3    4
C***  DATA ACCORDINGLY                                                   S3    5
C                                                                        S3    6
      IMPLICIT REAL*8(A-H,O-Z)                                           S3    7
      DIMENSION WK(2,6),DWK(2),F(3),X(3),TOL(2),TWK(21),TWJ(6),TWKK(36), S3    8
     1RR(21),CC(6),C(6,6),Z(6,1),WB(100),LSP(9),BK(36),DD(2),COST(10),SD S3    9
     1V(10,6),ACOST(10),SI(450,3),SW(450,1),SWK(250),DFPA(450),FPA1(450) S3   10
     1,FPA2(450),SA(450,2)                                               S3   11
      COMMON TITLE(20),D(450,11),TIME(450),A(100),W(100),F1(450),F2(450) S3   12
     1,F3(450),F4(450),F5(450),F6(450),F7(450),F8(450),IT,RHO,PI,G,JKS,N S3   13
     1ETRIC,JREAD,JWRITE,JPUNCH,IERR                                     S3   14
      COMMON /CARRY/F11(450),F12(450)                                    S3   15
      COMMON /TEMP1/SI(450,4),PAR(6),PSL,TSL,IPAR                        S3   16
      COMMON /TEMP2/F9(450),F10(450),F13(450),F14(450),AP(6),W(6)        S3   17
      INTEGER LISP8(10)/0,1,1,1,1,1,1,1,1,1/                             S3   18
C                                                                        S3   19
C***  INITIALIZE PARAMETERS                                              S3   20
      LCN1=0                                                             S3   21
      LMAX=10                                                            S3   22
      ITEST=0                                                            S3   23
      DO 1 J=1,6                                                         S3   24
      IF (LL.GT.1)W(J)=W(J)/2.0D0                                        S3   25
    1 PAR(J)=0.0D0                                                       S3   26
      K1=PSL/TSL                                                         S3   27
      X2=F10(1)                                                          S3   28
C***  COMPUTE FLIGHT PATH ANGLE AND ITS DERIVATIVE                       S3   29
      DO 2 L=1,K                                                         S3   30
      FPA1(L)=DARSIN(F11(L)/F4(L))                                       S3   31
      FPA2(L)=FPA1(L)                                                    S3   32
      DFPA(L)=(F4(L)*F12(L)-F11(L)*F8(L))/(F4(L)*DSQRT(1.0D0-(F11(L)/F4( S3   33
     1L))**2)*F4(L))                                                     S3   34
    2 CONTINUE                                                           S3   35
C***  FIND COMPATIBLE ANGLE OF ATTACK                                    S3   36
    3 NCN1=0                                                             S3   37
      DO 9 L=1,K                                                         S3   38
C***  SOLVE FOR ANGLE OF ATTACK BY NEWTON RAPHSON                        S3   39
      ITR=0                                                              S3   40
      ALP=F6(L)                                                          S3   41
      XP1=G*DSIN(FPA2(L))*F8(L)                                          S3   42
      XE2=G*DCOS(FPA2(L))*DFPA(L)*F4(L)                                  S3   43
    4 ITR=ITR+1                                                          S3   44
      FN=ST(L,N)-XP1*DCOS(ALP)-XP2*DSIN(ALP)+XAX*F3(L)*F3(L)             S3   45
      FNP=XP1*DSIN(ALP)-XE2*DCOS(ALP)                                    S3   46
      FNPP=XP1*DCOS(ALP)+XP2*DSIN(ALP)                                   S3   47
      RAD=(FNP/FNPP)*(FNP/FNPP)-2.0D0*(FN/FNPP)                          S3   48
      ALP1=ALP                                                           S3   49
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      IF (BAD.LT.0.0D0) GO TO 6                                          S3  50
      IF ((FPRE*FNPP).LT.0.0D0) GO TO 5                                  S3  51
      ALP=ALP-FNP/FNPP-DSQRT(BAD)                                        S3  52
      GO TO 7                                                            S3  53
    5 ALP=ALP-FNP/FNPP-DSQRT(BAD)                                        S3  54
      GO TO 7                                                            S3  55
    6 ALP=ALP-FNP/FNPP                                                   S3  56
      NCNT=NCNT+1                                                        S3  57
      GO TO 8                                                            S3  58
    7 IF (DABS(ALP1-ALP).LT.1.0D-15.OR.ITR.EQ.20) GO TO 9                S3  59
      GO TO 4                                                            S3  60
C***  FORM COEFFICIENTS FOR LEAST SQUARES                                S3  61
    8 SB(I,1)=ALP                                                        S3  62
      SL(I,1)=1.0D0                                                      S3  63
      SL(I,2)=P6(I)                                                      S3  64
      SL(I,3)=P6(I)*P6(I)                                                S3  65
    9 CONTINUE                                                           S3  66
      IF (NCNT.NE.0) WRITE (JWRITE,10) NCNT                              S3  67
   10 FORMAT (1H,//,10X,104H*** DURING NEWTON-RAPHSON TO FIND COMPATIBLE S3  68
     1 ANGLE OF ATTACK, THE ROUTINE WISHED TO SEEK  COMPLEX  ROOTS,I3,7H S3  69
     1 TIMES.***/)                                                       S3  70
C***  EXACT LEAST SQUARES TO DETERMINE BIAS AND GAIN ESTIMATES           S3  71
      CALL LLSQAR(SL,SB,K,3,1,450,450,15,SWK,IER,JWRITE)                 S3  72
      WRITE (JWRITE,11) (SB(I,1),I=1,3)                                  S3  73
   11 FORMAT (31X,'COMPATIBILITY ESTIMATES OF THE |   BIAS = ',1PD23.15, S3  74
     1/,31X,'BIAS AND GAINS BETWEEN INPUT   |-> FIRST-ORDER GAIN  = ',1P S3  75
     1D23.15,/,31X,'AND CALCULATED ANGLE OF ATTACK |   SECOND-ORDER GAIN S3  76
     1 = ',1PD23.15,/)                                                   S3  77
C***  COMPUTE AN ANGLE-OF-ATTACK VARIANCE INDICATION AND NEW VALUES OF   S3  78
C***  ANGLE OF ATTACK                                                    S3  79
      AVI=0.0D0                                                          S3  80
      DO 12 I=1,K                                                        S3  81
      SA(I,1)=P6(I)                                                      S3  82
      OLD=P6(I)                                                          S3  83
      P6(I)=SB(1,1)+P6(I)*(SB(2,1)+P6(I)*SB(3,1))                        S3  84
   12 AVI=AVI+(P6(I)-OLD)*(P6(I)-OLD)                                    S3  85
      WRITE (JWRITE,13) AVI                                              S3  86
   13 FORMAT (31X,'ANGLE-OF-ATTACK VARIANCE INDICATION = ',1PD13.6,//)   S3  87
C***  CHECK FOR INCREASING FIT ERROR                                     S3  88
      IF (ICNT.EQ.0) SAVI=AVI                                            S3  89
      IF (ICNT.EQ.0) GO TO 16                                            S3  90
      IF (AVI.GT.SAVI) GO TO 14                                          S3  91
      SAVI=AVI                                                           S3  92
      GO TO 16                                                           S3  93
C***  RESET ANGLE OF ATTACK AND FLIGHT PATH ANGLE                        S3  94
   14 DO 15 I=1,K                                                        S3  95
      P6(I)=SA(I,1)                                                      S3  96
      IF (ICNT.EQ.1) SA(I,2)=FPA1(I)                                     S3  97
   15 FPA2(I)=SA(I,2)                                                    S3  98
C***  BEGIN LOOP FOR SUCCESSIVE MINIMIZATIONS                            S3  99
   16 CALL FNI(K,P6,TIME,P9,F14,1,15,3)                                  S3 100
C***  TEST FOR MAXIMUM ITERATION OR INCREASING FIT ERROR                 S3 101
      IF (ICNT.GE.10.OR.AVI.GT.SAVI) GO TO 19                            S3 102
C***  DETERMINE COMPATIBILITY ESTIMATES FOR FLIGHT PATH ANGLE            S3 103
      XGAM=F2(1)-P6(1)                                                   S3 104
      IF (ICNT.NE.0) XGAM=FPA2(1)                                        S3 105
C***  FORM THE COEFFICIENTS FOR LEAST SQUARES                            S3 106
      SB(1,1)=XGAM                                                       S3 107
      SL(1,1)=1.0D0                                                      S3 108
      SL(1,2)=FPA2(1)                                                    S3 109
      SL(1,3)=FPA2(1)**2                                                 S3 110
      DO 17 I=2,K                                                        S3 111
C***  INTEGRATE RATES FOR FLIGHT PATH ANGLE                              S3 112
      XGAM=F2(I)-P6(I)                                                   S3 113
      SB(I,1)=XGAM                                                       S3 114
      SL(I,1)=1.0D0                                                      S3 115
      SL(I,2)=FPA2(I)                                                    S3 116
   17 SL(I,3)=FPA2(I)**2                                                 S3 117
C***  EXACT LEAST SQUARES FOR BIAS AND GAINS                             S3 118
      CALL LLSQAR(SL,SB,K,3,1,450,450,15,SWK,IER,JWRITE)                 S3 119
C***  COMPUTE THE FITTED FLIGHT PATH ANGLE                               S3 120
      DO 18 I=1,K                                                        S3 121
      IF (ICNT.GT.0) SA(I,2)=FPA2(I)                                     S3 122
   18 FPA2(I)=SB(1,1)+SB(2,1)*FPA2(I)+SB(3,1)*FPA2(I)**2                 S3 123
C***  OBTAIN ITS DERIVATIVE                                              S3 124
      CALL FNI(K,FPA2,TIME,DFPA,F14,1,15,3)                              S3 125
C***  RECOMPUTE COMPATIBLE ANGLE OF ATTACK                               S3 126
      ICNT=ICNT+1                                                        S3 127
      GO TO 3                                                            S3 128
C***  COMPUTE NEW ALTITUDE AND STATIC PRESSURE                           S3 129
   19 HX=H2                                                              S3 130
      DO 21 I=1,K                                                        S3 131
      IF (I.EQ.1) GO TO 20                                               S3 132
      HX=HX+0.5D0*(TIME(I)-TIME(I-1))*(P6(I)*DSIN(FPA2(I))+P6(I-1)*DSIN( S3 133
     1FPA2(I-1)))                                                        S3 134
   20 ST(I,2)=X1*P7(I)*(1.0D0-6.8ED-6*HX)**4.26DG                        S3 135
   21 CONTINUE                                                           S3 136
      XMAX=0.0D0                                                         S3 137
      DO 46 I=1,LMAX                                                     S3 138
      IF (LL.EQ.NUM) GO TO 25                                            S3 139
      WRITE (JWRITE,22) LL,L                                             S3 140
   22 FORMAT (31X,'ITERATION',I2,3X,'SUBITERATION',I2,/)                 S3 141
C***  STORE DELTA VALUES                                                 S3 142
      DO 23 I=1,6                                                        S3 143
   23 SDV(L,I)=PAR(I)                                                    S3 144
C***  INITIALIZE MATRICES                                                S3 145
      DO 24 JXP=1,21                                                     S3 146
      RB(JXP)=0.0D0                                                      S3 147
      IF (JXP.GT.6) GO TO 24                                             S3 148
      CC(JXP)=0.0D0                                                      S3 149
   24 CONTINUE                                                           S3 150
C***  COMPUTE MAXIMUM PRESSURE AND ACCELERATION                          S3 151
   25 XMAX=DABS(ST(1,2))                                                 S3 152
      YMAX=DABS(ST(1,4))                                                 S3 153
      DO 26 JXP=2,K                                                      S3 154
      IF (DABS(ST(JXP,2)).GT.XMAX) XMAX=DABS(ST(JXP,2))                  S3 155
      IF (DABS(ST(JXP,4)).GT.YMAX) YMAX=DABS(ST(JXP,4))                  S3 156
   26 CONTINUE                                                           S3 157
C***  COMPUTE WEIGHT FACTORS                                             S3 158
      RB(1)=1.0D0/(XMAX*XMAX)                                            S3 159
      RB(2)=1.0D0/(YMAX*YMAX)                                            S3 160
      X(1)=0.0D0                                                         S3 161
      X(2)=0.0D0                                                         S3 162
      X(3)=0.0D0                                                         S3 163
      TOL(1)=0.0D0                                                       S3 164
      TOL(2)=0.0D0                                                       S3 165
C***  BEGIN COMPUTING PARAMETERS FOR PARTIAL DERIVATIVE EVALUATIONS      S3 166
      DO 35 I=1,K                                                        S3 167
      X4=P3(I)-P9(I)                                                     S3 168
      X5=P2(I)-P6(I)                                                     S3 169
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      X6=P3(I)*P3(I)                                                    S3  170
      X7=G*DSIN(P2(I))                                                  S3  171
      X8=G*DCOS(P2(I))                                                  S3  172
      X9=P8(I)*DCOS(P6(I))                                              S3  173
      X10=P8(I)*DSIN(P6(I))                                             S3  174
      X11=P4(I)*X4*DSIN(P6(I))                                          S3  175
      X12=P4(I)*X4*DCOS(P6(I))                                          S3  176
      X13=X12-X10                                                       S3  177
C***  CHECK FOR INITIAL POINT CALCULATION                               S3  178
      IF (I.NE.1) GO TO 27                                              S3  179
      X(1)=X2                                                           S3  180
      X3=0.0D0                                                          S3  181
   27 IF (I.EQ.1) GO TO 29                                              S3  182
      X3=(P7(I)-P7(I-1))/(TIME(I)-TIME(I-1))                            S3  183
C***  FIND POINT-TO-POINT INTEGRALS                                     S3  184
      F(1)=P4(I)*DSIN(X5)*P4(I-1)*DSIN(P2(I-1)-P6(I-1))                 S3  185
      F(2)=P4(I)*DCOS(X5)*P4(I-1)*DCOS(P2(I-1)-P6(I-1))                 S3  186
      F(3)=P3(I)*P4(I)*DCOS(X5)*P3(I-1)*P4(I-1)*DCOS(P2(I-1)-P6(I-1))   S3  187
      DO 28 J=1,3                                                       S3  188
   28 X(J)=X(J)+0.5D0*(TIME(I)-TIME(I-1))*F(J)                          S3  189
   29 X14=1.0D0-6.86D-6*(X(1)+PAR(6)*X(2)-XPAR*X(J))                    S3  190
      X15=X14**3.26D0                                                   S3  191
      IF (II.EQ.NUM) GO TO 30                                           S3  192
C***  COMPUTE PARTIAL DERIVATIVES                                       S3  193
      WK(1,1)=X6                                                        S3  194
      WK(2,1)=0.0D0                                                     S3  195
      WK(1,2)=ST(I,4)                                                   S3  196
      WK(2,2)=0.0D0                                                     S3  197
      WK(1,3)=X7                                                        S3  198
      WK(2,3)=0.0D0                                                     S3  199
      WK(1,4)=0.0D0                                                     S3  200
      WK(2,4)=X8*X13                                                    S3  201
      WK(1,5)=X14*P7(I)*X15*(29.2236D-6*(X(3)*(1.0D0-XPAR*X3/P7(I)))-X3*X S3  202
     1*P7(I))                                                           S3  203
      WK(2,5)=-P3(I)*X8                                                 S3  204
      WK(1,6)=-29.2236D-6*X14*P7(I)*(1.0D0-XPAR*X3/P7(I))*X15*X(2)      S3  205
      WK(2,6)=-X13                                                      S3  206
C***  COMPUTE STATIC PRESSURE AND LONGITUDINAL ACCELERATION             S3  207
   30 DWK(1)=X1*P7(I)*(1.0D0-XPAR*X3/P7(I))*X15*X14+PAR(1)*X6+PAR(2)*ST( S3  208
     1I,4)+PAR(3)*X7                                                    S3  209
      DWK(2)=X9*X11-XAX*X6+X7*PAR(4)*(X8+X13)-XPAR*X8*P3(I)-PAR(6)*X13  S3  210
C***  COMPUTE PRESSURE AND LONGITUDINAL ACCELERATION DIFFERENCES        S3  211
      DWK(1)=ST(I,2)-DWK(1)                                             S3  212
      DWK(2)=ST(I,4)-DWK(2)                                             S3  213
      IF (LL.EQ.NUM) GO TO 33                                           S3  214
C***  SUM MATRICES OF PARTIALS                                          S3  215
      JP=0                                                              S3  216
      STWJ=0.0D0                                                        S3  217
      DO 32 JJ=1,6                                                      S3  218
      DO 31 J=1,2                                                       S3  219
      JP=JP+1                                                           S3  220
      TWK(JP)=WK(J,JJ)*DSQRT(DW(J))                                     S3  221
   31 STWJ=STWJ+TWK(JP)*DWK(J)*DSQRT(DW(J))                             S3  222
   32 TWJ(JJ)=STWJ                                                      S3  223
      NS=0                                                              S3  224
      CALL MATA(TWK,THKK,2,6,NS)                                        S3  225
      CALL MATD(HH,THKK,6,6,1)                                          S3  226
      CALL MATD(CC,TWJ,6,1,0)                                           S3  227
C***  SUM DIFFERENCES SQUARED                                           S3  228
   33 DO 34 J=1,2                                                       S3  229
      TOL(J)=TOL(J)+DWK(J)*DWK(J)                                       S3  230
   34 CONTINUE                                                          S3  231
C***  CONTINUE                                                          S3  232
C***  COMPUTE COST FUNCTION AND TOLERANCES                              S3  233
      PCP=0.0D0                                                         S3  234
      IF (LL.EQ.NUM) GO TO 37                                           S3  235
      DO 36 J=1,6                                                       S3  236
   36 PCP=PCP+W(J)*(PAR(J)-AP(J))**2/(AP(J)*AP(J))                      S3  237
   37 COST(L)=DW(1)*TOL(1)+DW(2)*TOL(2)+PCP                             S3  238
      DO 38 I=1,2                                                       S3  239
   38 TOL(I)=TOL(I)/K                                                   S3  240
      WRITE (JWRITE,39) COST(L),(TOL(I),I=1,2)                          S3  241
   39 FORMAT (31X,'COST FUNCTION (J) = ',1PD23.16,/,31X,'WITH:'/,37X,'S S3  242
     1TATIC PRESSURE TOLERANCE = ',1PD23.16,/,37X,'LONGITUDINAL ACCELERA S3  243
     1TION TOLERANCE = ',1PD23.16,///)                                  S3  244
C***  CHECK FOR INCREASE IN COST FUNCTION                               S3  245
      IF (LL.EQ.NUM) GO TO 56                                           S3  246
      IF (L.LT.3) GO TO 40                                              S3  247
      IF (COST(L).GE.COST(L-1)) GO TO 47                                S3  248
C***  ADJUST MATRICES FOR LEAST SQUARES SOLUTION                        S3  249
   40 CALL MSTR(HH,HX,6,1,0)                                            S3  250
      JP=0                                                              S3  251
      DO 42 JJ=1,6                                                      S3  252
      DO 41 J=1,6                                                       S3  253
      XFAC=1.0D0                                                        S3  254
      IF (JJ.EQ.J) XFAC=1.00005D0                                       S3  255
      JP=JP+1                                                           S3  256
      XC=HX(JP)                                                         S3  257
      IF (J.EQ.JJ) XC=XC+2.0D0*W(JJ)/(AP(JJ)*AP(JJ))                    S3  258
      C(J,JJ)=XC*XFAC                                                   S3  259
   41 CONTINUE                                                          S3  260
      Z(JJ,1)=CC(JJ)+2.0D0*W(JJ)*(AP(JJ)-PAR(JJ))/(AP(JJ)*AP(JJ))      S3  261
   42 CONTINUE                                                          S3  262
      N=6                                                               S3  263
C***  REDUCE MATRIX ORDER AS SPECIFIED BY USER                          S3  264
      CALL REDUCE(C,Z,N,LL)                                             S3  265
      IF (N.EQ.0) ITEST=1                                               S3  266
      IF (ITEST.NE.0) GO TO 56                                          S3  267
C***  EXACT LEAST SQUARES SOLUTION                                      S3  268
      CALL LLSQAR(C,Z,N,N,1,6,6,15,WK,IER,JWRITE)                       S3  269
C***  TEST FOR ERROR                                                    S3  270
      IF (IER.EQ.129) IER=-1                                            S3  271
      IF (IER.NE.0) RETURN                                              S3  272
      CALL RESET(Z,N)                                                   S3  273
C***  WRITE SOLUTION VALUES                                             S3  274
      WRITE (JWRITE,43) (Z(I,1),I=1,6)                                  S3  275
   43 FORMAT (38X,'1ST LINEAR ACCELERATION DEPENDENCY DELTA= ',D13.6,/,3 S3  276
     1X,'2ND LINEAR ACCELERATION DEPENDENCY DELTA= ',D13.6,/,38X,'3RD L S3  277
     1INEAR ACCELERATION DEPENDENCY DELTA= ',D13.6,/,38X,'PITCH ANGLE BI S3  278
     1AS DELTA = ',D13.6,/,38X,'PHASE SHIFT DELTA = ',D13.6,/,38X,'FLIGH S3  279
     1T PATH ANGLE DELTA= ',D13.6,/)                                    S3  280
C***  SUM DELTAS                                                        S3  281
      DO 44 J=1,6                                                       S3  282
   44 PAR(J)=SDV(I,J)+Z(J,1)                                            S3  283
      WRITE (JWRITE,45) (PAR(I),I=1,6)                                  S3  284
   45 FORMAT (42X,'UPDATED 1ST LINEAR ACCELERATION DEPENDENCY= ',D13.6,/ S3  285
     1,42X,'UPDATED 2ND LINEAR ACCELERATION DEPENDENCY= ',D13.6,/,42X,'U S3  286
     1PDATED 3RD LINEAR ACCELERATION DEPENDENCY= ',D13.6,/,42X,'UPDATED  S3  287
     1PITCH ANGLE BIAS= ',D13.6,/,42X,'UPDATED PHASE SHIFT= ',D13.6,/,42 S3  288
     1X,'UPDATED FLIGHT PATH ANGLE BIAS= ',D13.6,///)                   S3  289
      XPAR=PAR(5)
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   46 CONTINUE                                                          S3  290
      ACOST(LL)=CCST(L)                                                 S3  291
      GO TO 49                                                          S3  292
C***  ADJUST COST FUNCTION AND DELTAS                                   S3  293
   47 ACCST(LL)=CCST(L-1)                                               S3  294
      DO 48 J=1,6                                                       S3  295
   48 PAR(J)=SDV(L-1,J)                                                 S3  296
C***  TEST FOR INCREASE IN COST FUNCTION                                S3  297
   49 IF (LL.EQ.1) GO TO 50                                             S3  298
      IF (ACOST(LL).GE.ACOST(LL-1))ITEST=1                              S3  299
   50 IF ((ITEST.EQ.1.OR.LL.EQ.NUM) GO TO 54                            S3  300
C***  WRITE BEST RESULTS                                                S3  301
      WRITE (JWRITE,51) L,ACOST(LL)                                     S3  302
   51 FORMAT (36X,13HOF THE ABOVE ,I2,44H ITERATIONS, THE BEST COST FUNC S3  303
     1TION HAS BEEN,/,36X,22HCHOSEN TO BE EQUAL TO ,D23.16,16H, AND THE  S3  304
     1VALUES,/,36X,61HASSOCIATED WITH THIS COST FUNCTION (PHASE SHIFT VA S3  305
     1LUE IS SUB-,/,36X,62HJECT TO A MAGNITUDE AND SIGN RESTRICTION) WIL S3  306
     1L BE USED TO MOD-,/,36X,9HIFY DATA.,////)                         S3  307
C***  DETERMINE PHASE SHIFT                                             S3  308
      IF (PAR(5).GT.1.0D0)PAR(5)=1.0D0                                  S3  309
      IF (PAR(5).LT.0.0D0)IFAR=0                                        S3  310
      IF (IPAR.EQ.0) GO TO 52                                           S3  311
      PAR(5)=DSPS*PAR(5)                                                S3  312
      LP=PAR(5)                                                         S3  313
      LPX=LP+1                                                          S3  314
      XLP=LP                                                            S3  315
      XLPX=LPX                                                          S3  316
      IF ((PAR(5)-XLP).LT.0.5D0)IPAR=LP                                 S3  317
      IF ((XLPX-PAR(5)).LE.0.5D0)IPAR=LPX                               S3  318
      PAR(5)=PAR(5)/DSPS                                                S3  319
C***  ADJUST DATA WITH RESPECT TO DETERMINED DATA-DEPENDENT PARAMETERS   S3  320
   52 KR=R-IPAR                                                         S3  321
      DO 53 I=1,KR                                                      S3  322
      K=KR                                                              S3  323
      D(I,1)=F1(I)                                                      S3  324
      IF (LSP(1).NE.0)F2(I)=F2(I+IPAR)                                  S3  325
      F2(I)=F2(I)+PAR(4)                                                S3  326
      D(I,2)=F2(I)                                                      S3  327
      IF (LSP(2).NE.0)F3(I)=F3(I+IPAR)                                  S3  328
      D(I,3)=F3(I)                                                      S3  329
      IF (LSP(3).NE.0)ST(I,3)=ST(I+IPAR,3)                              S3  330
      D(I,4)=ST(I,3)                                                    S3  331
      IF (LSP(3).NE.0)F4(I)=F4(I+IPAR)                                  S3  332
      IF (LSP(4).NE.0)ST(I,2)=ST(I+IPAR,2)                              S3  333
      D(I,5)=ST(I,2)                                                    S3  334
      IF (LSP(5).NE.0)F6(I)=F6(I+IPAR)                                  S3  335
      F6(I)=F6(I)*PAR(4)-PAR(6)                                         S3  336
      D(I,6)=F6(I)                                                      S3  337
      IF (LSP(5).NE.0)F9(I)=F9(I+IPAR)                                  S3  338
      IF (LSP(6).NE.0)ST(I,1)=ST(I+IPAR,1)                              S3  339
      D(I,7)=ST(I,1)                                                    S3  340
      IF (LSP(7).NE.0)ST(I,4)=ST(I+IPAR,4)                              S3  341
      D(I,8)=ST(I,4)                                                    S3  342
      IF (LSP(7).NE.0)F8(I)=F8(I+IPAR)                                  S3  343
      IF (LSP(8).NE.0)F13(I)=F13(I+IPAR)                                S3  344
      IF (LSP(9).NE.0)F14(I)=F14(I+IPAR)                                S3  345
C***  CHECK FOR REDEFINING INPUT STATIC PRESSURE                        S3  346
      IF (LLSPN(LL).EQ.0) GO TO 53                                      S3  347
      ST(I,2)=ST(I,2)-(PAR(1)*F3(I)**2+PAR(2)*ST(I,4)+PAR(3)*G*DSIN(F2(I S3  348
     1)))                                                               S3  349
   53 CONTINUE                                                          S3  350
      IF (ITEST.NE.0.AND.R.NE.0) WRITE (JWRITE,55)                      S3  351
   54 IF (ITEST.NE.0.AND.R.NE.0) WRITE (JWRITE,55)                      S3  352
   55 FORMAT (36X,58HNO COST FUNCTION HAS BEEN DETERMINED TO BE BETTER T S3  353
     1HAN THE,/,36X,56HPREVIOUS BEST COST FUNCTION.  THEREFORE, ITERATIO S3  354
     1NS HAVE,/,36X,15HBEEN CONCLUDED..///)                             S3  355
   56 RETURN                                                            S3  356
      END
```

```
      SUBROUTINE REDUCE(C,Z,N,LL)                                       RD    1
C                                                                       RD    2
C***  SUBROUTINE REDUCE DECREASES THE ORDER OF A SYMMETRIC MATRIX BY THE RD    3
C***  ELIMINATION OF THE I-TH ROW AND COLUMN                            RD    4
C                                                                       RD    5
      IMPLICIT REAL*8(A-H,O-Z)                                          RD    6
      DIMENSION C(6,6),Z(6,1),IR(6),B(6,6),S(6,1)                       RD    7
      COMMON /ROW/IRS(10,6)                                             RD    8
C                                                                       RD    9
C***  INITIALIZE PARAMETERS                                             RD   10
      NR=N                                                              RD   11
      DO 1 I=1,6                                                        RD   12
    1 IR(I)=IRS(LL,I)                                                   RD   13
      IJ=0                                                              RD   14
      NR=0                                                              RD   15
      IP=0                                                              RD   16
C***  DETERMINE FIRST ROW/COLUMN NOT ELIMINATED                         RD   17
      DO 2 I=1,N                                                        RD   18
      IF (IR(I).NE.0)IJ=I                                               RD   19
      IF (IR(I).NE.0) GO TO 3                                           RD   20
    2 CONTINUE                                                          RD   21
C***  IF IJ=0, USER SPECIFIED A NO MATRIX CONDITION                     RD   22
      GO TO 8                                                           RD   23
C***  DEFINE NEW ELEMENTS IN TERMS OF OLD ELEMENTS                      RD   24
    3 DO 5 I=1,N                                                        RD   25
      IF (IR(I).EQ.0) GO TO 5                                           RD   26
      NR=NR+1                                                           RD   27
      IP=IP+1                                                           RD   28
      JP=0                                                              RD   29
      DO 4 J=IJ,N                                                       RD   30
      IF (IR(J).EQ.0) GO TO 4                                           RD   31
      JP=JP+1                                                           RD   32
      B(IP,JP)=C(I,J)                                                   RD   33
    4 CONTINUE                                                          RD   34
      S(IP,1)=Z(I,1)                                                    RD   35
    5 CONTINUE                                                          RD   36
C***  DEFINE UPDATED ELEMENTS BY THE NEW ELEMENTS                       RD   37
      N=NR                                                              RD   38
      DO 7 I=1,N                                                        RD   39
      DO 6 J=1,N                                                        RD   40
      C(I,J)=B(I,J)                                                     RD   41
    6 CONTINUE                                                          RD   42
      Z(I,1)=S(I,1)                                                     RD   43
    7 CONTINUE                                                          RD   44
      RETURN                                                            RD   45
C***  SET CODE FOR NO-MATRIX SPECIFICATION                              RD   46
    8 N=0                                                               RD   47
      RETURN                                                            RD   48
C                                                                       RD   49
      ENTRY RESET(Z,N)                                                  RD   50
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C                                                                       RD   51
C***  ENTRY RESET ADJUSTS THE SOLUTION TO BE COMPATIBLE WITH THE        RD   52
C***  ORIGINAL MATRIX                                                   RD   53
C                                                                       RD   54
      NN=0                                                              RD   55
      N=NB                                                              RD   56
      DO 9 I=1,N                                                        RD   57
      S(I,1)=0.0D0                                                      RD   58
      IF (IB(I).EQ.0) GO TO 9                                           RD   59
      NN=NN+1                                                           RD   60
      S(I,1)=Z(NN,1)                                                    RD   61
    9 CONTINUE                                                          RD   62
      DO 10 I=1,N                                                       RD   63
   10 Z(I,1)=S(I,1)                                                     RD   64
      RETURN                                                            RD   65
      END                                                               RD   66


      SUBROUTINE SHIFT(K,LSP,NSPTS)                                     SH    1
C                                                                       SH    2
C***  SUBROUTINE SHIFT ADJUSTS DATA FOR PHASE SHIFT                     SH    3
C                                                                       SH    4
      IMPLICIT REAL*8(A-H,O-Z)                                          SH    5
      DIMENSION LSP(9)                                                  SH    6
      COMMON TL(20),D(450,11),T(450),A(100),B(100),F1(450),F2(450),F3(45 SH    7
     10),AS(450),P(450),PD(450),PS(450),PSD(450),TT,RHO,PI,G,JP,M,JB,JW, SH    8
     1JH                                                                SH    9
C                                                                       SH   10
      L=1                                                               SH   11
      KM=K-NSPTS                                                        SH   12
      DO 2 I=1,9                                                        SH   13
      IF (K.GT.7) I=2                                                   SH   14
      IF (LSP(I).EQ.0) GO TO 2                                          SH   15
      DO 1 J=1,KM                                                       SH   16
    1 D(J,I+L)=D(J+NSPTS,I+L)                                           SH   17
    2 CONTINUE                                                          SH   18
      K=KM                                                              SH   19
      RETURN                                                            SH   20
      END                                                               SH   21


      SUBROUTINE PARAF(FNT,K,NR1,EC)                                    PF    1
C                                                                       PF    2
C***  SUBROUTINE PARAF USES PARABOLIC INTEGRATION TO FORM FOURIER       PF    3
C***  SERIES COEFFICIENTS                                               PF    4
C                                                                       PF    5
      IMPLICIT REAL*8(A-H,O-Z)                                          PF    6
      DIMENSION FNT(K),AA(100),BB(100),X(3593),F(3593),XY(3593),Y(3593) PF    7
      COMMON TL(20),D(450,11),TM(450),A(100),B(100),P1(450),P2(450),P3(4 PF    8
     150),ASPD(450),P(450),PD(450),PS(450),PSD(450),TT,RHO,PI,G,JP,MC,JB PF    9
     1,JW,JH                                                            PF   10
      REAL*8 MM                                                         PF   11
C                                                                       PF   12
C***  THE DIMENSION OF THE LARGE ARRAYS ARE DETERMINED BY:              PF   13
C***  (1)  N1=450+(450-1)*(NIP-1)                                       PF   14
C***  (2)  N2=N1+(N1-1)*(NIP-1)                                         PF   15
C***  (3)  N3=N2+(N2-1)*(NIP-1)  ----> N3=DIMENSION                     PF   16
C***  INITIALIZE PARAMETERS                                             PF   17
      NO=2.0D0*PI/TT                                                    PF   18
      TOL=1.0D-10                                                       PF   19
      KK=K                                                              PF   20
      DO 1 I=1,K                                                        PF   21
      X(I)=TM(I)                                                        PF   22
    1 F(I)=FNT(I)                                                       PF   23
      KB=K                                                              PF   24
C***  BEGIN IMPROVEMENT SCHEME                                          PF   25
      DO 5 JJK=1,3                                                      PF   26
      KCN1=(KB-1)/2                                                     PF   27
      L=1                                                               PF   28
      IP=0                                                              PF   29
C***  DETERMINE SLOPE DIFFERENCES                                       PF   30
      DO 4 J=1,KCN1                                                     PF   31
      B=((F(L)-F(L+1))/(X(L)-X(L+1))-(F(L+1)-F(L+2))/(X(L+1)-X(L+2)))/(X PF   32
     1(L)-X(L+2))                                                       PF   33
      S=(F(L)-F(L+1))/(X(L)-X(L+1))-(X(L)+X(L+1))*B                     PF   34
      T=F(L)-X(L)*(B*X(L)+S)                                            PF   35
      S1=2.0D0*B*X(L)+S                                                 PF   36
      S2=2.0D0*B*X(L+2)+S                                               PF   37
      IF (J.GT.1) GO TO 2                                               PF   38
      GO TO 3                                                           PF   39
    2 IF (J.EQ.2) AMSD=DABS(S1-SX)                                      PF   40
      IF (DABS(S1-SX).GT.TOL) IP=IP+1                                   PF   41
      IF (DABS(S1-SX).GT.AMSD) AMSD=DABS(S1-SX)                         PF   42
    3 SX=S2                                                             PF   43
    4 L=L+2                                                             PF   44
      IF (IP.NE.0) GO TO 5                                              PF   45
      GO TO 10                                                          PF   46
C***  USE NEWTON'S INTERPOLATION FORMULA TO COMPUTE ADDITIONAL POINTS    PF   47
    5 NIP=1                                                             PF   48
      DF=1.0D-12                                                        PF   49
      N=0                                                               PF   50
      L=1                                                               PF   51
      J=6                                                               PF   52
      XX=X(L)                                                           PF   53
      XXN=X(K)                                                          PF   54
      EC=0.0D0                                                          PF   55
    6 N=N+1                                                             PF   56
C***  DETERMINE ARGUMENT VALUES                                         PF   57
      XX=XX+EC                                                          PF   58
      IF (DABS(XX-XXN).LT.DF) XX=XXN                                    PF   59
      IF (XX.GT.XXN) GO TO 7                                            PF   60
      IF (DABS(XX-X(L+1)).LT.DF) XX=X(L+1)                              PF   61
      IF (XX.EQ.X(L+1).AND.XX.LT.XXN) L=L+1                             PF   62
      IF (DABS(XX-X(J-2)).LT.DF) XX=X(J-2)                              PF   63
      IF (XX.EQ.X(J-2).AND.J.LT.K) J=J+1                                PF   64
C***  COMPUTE THE NEWTONIAN COEFFICIENTS                                PF   65
      A0=F(J-5)                                                         PF   66
      A1=(F(J-4)-F(J-5))/(X(J-4)-X(J-5))                                PF   67
      A2=((F(J-3)-(A0+A1*(X(J-3)-X(J-5))))/((X(J-3)-X(J-5))*(X(J-3)-X(J-4 PF   68
     1)))                                                               PF   69
      A3=((F(J-2)-(A0+A1*(X(J-2)-X(J-5))+A2*(X(J-2)-X(J-5))*(X(J-2)-X(J-4 PF   70
     1))))/((X(J-2)-X(J-5))*(X(J-2)-X(J-4))*(X(J-2)-X(J-3)))            PF   71
      A4=((F(J-1)-(A0+A1*(X(J-1)-X(J-5))+A2*(X(J-1)-X(J-5))*(X(J-1)-X(J-4 PF   72
     1))+A3*(X(J-1)-X(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3))))/((X(J-1)-X PF   73
     1(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3))*(X(J-1)-X(J-2)))           PF   74
      A5=(F(J)-(A0+A1*(X(J)-X(J-5))+A2*(X(J)-X(J-5))*(X(J)-X(J-4))+A3*(X PF   75
     1(J)-X(J-5))*(X(J)-X(J-4))*(X(J)-X(J-3))+A4*(X(J)-X(J-5))*(X(J)-X(J PF   76
     1-4))*(X(J)-X(J-3))*(X(J)-X(J-2))))/((X(J)-X(J-5))*(X(J)-X(J-4))*(X PF   77
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     1(J)-X(J-3))*(X(J)-X(J-2))*(X(J)-X(J-1)))                                  PF   78
C***  COMPUTE ADDITIONAL FUNCTION VALUES                                        PF   79
      Y(M)=A0+A1*(XX-X(J-5))+A2*(XX-X(J-5))*(XX-X(J-4))+A3*(XX-X(J-5))*(       PF   80
     1XX-X(J-4))*(XX-X(J-3))+A4*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX-       PF   81
     1X(J-2))+A5*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX-X(J-2))*(XX-X(J       PF   82
     1-1))                                                                      PF   83
      XX(M)=XX                                                                  PF   84
      XC=(X(L+1)-X(L))/(NIP+1)                                                  PF   85
      GO TO 6                                                                   PF   86
    7 KB=M-1                                                                    PF   87
      K=KB                                                                      PF   88
      DO 8 I=1,KB                                                               PF   89
      X(I)=XX(I)                                                                PF   90
    8 F(I)=Y(I)                                                                 PF   91
    9 CONTINUE                                                                  PF   92
C***  DETERMINE NUMBER OF INTERVALS                                             PF   93
   10 KC=(K-1)/2                                                                PF   94
      L=1                                                                       PF   95
      DO 17 J=1,KC                                                              PF   96
C***  SOLVE 3 EQUATIONS GIVES INTERVAL                                          PF   97
      B=((F(L)-F(L+1))/(X(L)-X(L+1))-(F(L+1)-F(L+2))/(X(L+1)-X(L+2)))/((X       PF   98
     1(L)-X(L+2))                                                               PF   99
      S=(F(L)-F(L+1))/(X(L)-X(L+1))-(A(L)+X(L+1))*B                             PF  100
      T=F(L)-X(L)*(B*X(L)+S)                                                    PF  101
C***  COMPUTE ZEROTH COEFFICIENTS FOR INTERVAL                                  PF  102
      AA(1)=(B*(X(L+2)**3-X(L)**3)/3.0D0+S*(X(L+2)**2-X(L)**2)/2.0D0+T*(       PF  103
     1X(L+2)-X(L)))/(TT)                                                        PF  104
      BB(1)=0.000                                                               PF  105
      DO 11 M=2,MP1                                                             PF  106
      MN=M-1                                                                    PF  107
C***  COMPUTE FIRST AND UPPER COEFFICIENTS FOR INTERVAL                         PF  108
      AA(M)=B*(2.0D0*X(L+2)*DCOS(RN*WO*X(L+2))/(RN**2*WO**2)+(RN**2*WO**        PF  109
     12*X(L+2)**2-2.0D0)*DSIN(RN*WC*X(L+2))/(RN**3*WO**3))/(TT)+S*(DCOS(        PF  110
     1RN*WO*X(L+2))/(RN**2*WO**2)+X(L+2)*DSIN(RN*WO*X(L+2))/(RN*WO))/(TT       PF  111
     1)+(T*DSIN(RN*WO*X(L+2))/(RN*WO))/(TT)-(B*(2.0D0*X(L)*DCOS(RN*WO*X(       PF  112
     1L))/(RN**2*WO**2)+(RN**2*WO**2*X(L)**2-2.0D0)*DSIN(RN*WO*X(L))/(RN       PF  113
     1**3*WO**3))/(TT)+S*(DCOS(RN*WO*X(L))/(RN**2*WO**2)+X(L)*DSIN(RN*WO       PF  114
     1*X(L))/(RN*WO))/(TT)+(T*DSIN(RN*WO*X(L))/(RN*WO))/(TT))                   PF  115
      AA(M)=2.0D0*AA(M)                                                         PF  116
      BB(M)=B*(2.0D0*X(L+2)*DSIN(RN*WO*X(L+2))/(RN**2*WO**2)-(RN**2*WO**        PF  117
     12*X(L+2)**2-2.0E0)*DCOS(RN*WC*X(L+2))/(RN**3*WO**3))/(TT)+S*(DSIN(       PF  118
     1RN*WC*X(L+2))/(RN**2*WO**2)-X(L+2)*DCOS(RN*WO*X(L+2))/(RN*WO))/(TT       PF  119
     1)-(T*DCOS(RN*WO*X(L+2))/(RN*WO))/(TT)-(B*(2.0D0*X(L)*DSIN(RN*WO*X(       PF  120
     1L))/(RN**2*WO**2)-(RN**2*WO**2*X(L)**2-2.0D0)*DCOS(RN*WO*X(L))/(RN       PF  121
     1*3*WO**3))/(TT)+S*(DSIN(RN*WO*X(L))/(RN**2*WO**2)-X(L)*DCOS(RN*WO       PF  122
     1*X(L))/(RN*WC))/(TT)-(T*DCOS(RN*WO*X(L))/(RN*WO))/(TT))                   PF  123
      BB(M)=2.0D0*BB(M)                                                         PF  124
   11 CONTINUE                                                                  PF  125
      IF (J.EQ.1) GO TO 12                                                      PF  126
      GO TO 14                                                                  PF  127
C***  SUM FOURIER SERIES COEFFICIENTS                                           PF  128
   12 DO 13 JJ=1,MP1                                                            PF  129
      A(JJ)=AA(JJ)                                                              PF  130
      B(JJ)=BB(JJ)                                                              PF  131
   13 CONTINUE                                                                  PF  132
   14 IF (J.GE.2) GO TO 15                                                      PF  133
      GO TO 17                                                                  PF  134
   15 DO 16 JJ=1,MP1                                                            PF  135
      B(JJ)=B(JJ)+BB(JJ)                                                        PF  136
   16 A(JJ)=A(JJ)+AA(JJ)                                                        PF  137
   17 L=L+2                                                                     PF  138
C***  FILTER FOURIER SERIES COEFFICIENTS TO REDUCE NOISE                        PF  139
      CALL FILTER(A,B,NC,MP1)                                                   PF  140
      K=KK                                                                      PF  141
      RETURN                                                                    PF  142
      END                                                                       PF  143


      SUBROUTINE TRAP(ND,X,DY,Y,YO)                                             TP    1
C                                                                               TP    2
C***  SUBROUTINE TRAP INTEGRATES A FUNCTION BY TRAPEZOIDAL RULE                 TP    3
C                                                                               TP    4
      IMPLICIT REAL*8(A-H,O-Z)                                                  TP    5
      DIMENSION X(ND),DY(ND),Y(ND)                                              TP    6
C                                                                               TP    7
C***  INITIALIZE PARAMETERS                                                     TP    8
      S2=YO                                                                     TP    9
      IF (ND-1)  4,3,1                                                          TP   10
C***  INTEGRATE OVER INTERVAL AND SUB                                           TP   11
    1 DO 2 I=2,ND                                                               TP   12
      S1=S2                                                                     TP   13
      S2=S2+0.5D0*(X(I)-X(I-1))*(DY(I)+DY(I-1))                                 TP   14
    2 Y(I-1)=S1                                                                 TP   15
    3 Y(ND)=S2                                                                  TP   16
    4 RETURN                                                                    TP   17
      END                                                                       TP   18


      SUBROUTINE FNI(K,F,X,FP,FPP,ND,NS,NI)                                     FN    1
C                                                                               FN    2
C***  SUBROUTINE FNI USES NEWTON'S INTERPOLATION FORMULA TO COMPUTE              FN    3
C***  ADDITIONAL POINTS FOR CUBIC SPLINE ANALYSIS                               FN    4
C                                                                               FN    5
      IMPLICIT REAL*8(A-H,O-Z)                                                  FN    6
      DIMENSION F(K),X(K),FP(K),FPP(K),XX(1827),Y(1827),AA(4,1827),FPS(1        FN    7
     1827)                                                                      FN    8
C                                                                               FN    9
C***  THE ARRAYS ARE PROTECTED AGAINST 'OVERFLOW' BY THE FOLLOWING CARDS        FN   10
      NB=K*(K-1)*NI+2*NS                                                        FN   11
      IF (NB.LE.1827) GO TO 1                                                   FN   12
      NI=1                                                                      FN   13
      NS=15                                                                     FN   14
      NB=K*(K-1)*NI+2*NS                                                        FN   15
C***  INITIALIZE PARAMETERS                                                     FN   16
    1 DF=1.0D-12                                                                FN   17
      H=X(2)-X(1)                                                               FN   18
      XX=-H                                                                     FN   19
      XC=DABS(XX/(NS+1))                                                        FN   20
      XXH=DABS(XX)+X(K)                                                         FN   21
      XCH=XC                                                                    FN   22
      M=0                                                                       FN   23
      L=1                                                                       FN   24
      J=6                                                                       FN   25
    2 M=M+1                                                                     FN   26
C***  DETERMINE THE INTERVAL IN QUESTION                                        FN   27
      XX=XX+XC                                                                  FN   28
      IF (DABS(XX-XXH).LT.DF) XX=XXH                                            FN   29
      IF (XX.GE.XXH) GO TO 3                                                    FN   30
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      IF (DABS(XX-X(L)).LT.DF)XX=X(L)                                   FN   31
      IF (DABS(XX-X(L+1)).LT.DF)XX=X(L+1)                               FN   32
      IF (XX.EQ.X(L+1).AND.XX.LT.X(K))L=L+1                             FN   33
      IF (DABS(XX-X(J-2)).LT.DF)XX=X(J-2)                               FN   34
      IF (XX.EQ.X(J-2).AND.J.LT.K)J=J+1                                 FN   35
C***  COMPUTE THE NEWTONIAN COEFFICIENTS                                FN   36
      A0=F(J-5)                                                         FN   37
      A1=(F(J-4)-F(J-5))/(X(J-4)-X(J-5))                                FN   38
      A2=(F(J-3)-(A0+A1*(X(J-3)-X(J-5))))/((X(J-3)-X(J-5))*(X(J-3)-X(J-4  FN   39
     1)))                                                               FN   40
      A3=(F(J-2)-(A0+A1*(X(J-2)-X(J-5))+A2*(X(J-2)-X(J-5))*(X(J-2)-X(J-4  FN   41
     1))))/((X(J-2)-X(J-5))*(X(J-2)-X(J-4))*(X(J-2)-X(J-3)))            FN   42
      A4=(F(J-1)-(A0+A1*(X(J-1)-X(J-5))+A2*(X(J-1)-X(J-5))*(X(J-1)-X(J-4  FN   43
     1))+A3*(X(J-1)-X(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3))))/((X(J-1)-X  FN   44
     1(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3))*(X(J-1)-X(J-2)))           FN   45
      A5=(F(J)-(A0+A1*(X(J)-X(J-5))+A2*(X(J)-X(J-5))*(X(J)-X(J-4))+A3*(X  FN   46
     1(J)-X(J-5))*(X(J)-X(J-4))*(X(J)-X(J-3))+A4*(X(J)-X(J-5))*(X(J)-X(J  FN   47
     1-4))*(X(J)-X(J-3))*(X(J)-X(J-2))))/((X(J)-X(J-5))*(X(J)-X(J-4))*(X  FN   48
     1(J)-X(J-3))*(X(J)-X(J-2))*(X(J)-X(J-1)))                          FN   49
C***  COMPUTE ADDITIONAL POINTS BY INTERPOLATION                        FN   50
      Y(N)=A0+A1*(XX-X(J-5))+A2*(XX-X(J-5))*(XX-X(J-4))+A3*(XX-X(J-5))*(  FN   51
     1XX-X(J-4))*(XX-X(J-3))+A4*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX-  FN   52
     1X(J-2))+A5*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX-X(J-2))*(XX-X(J  FN   53
     1-1))                                                              FN   54
      XX(N)=XX                                                          FN   55
C***  DETERMINE INTERVAL INCREMENT                                      FN   56
      IF (XX.GE.X(1).AND.XX.LT.X(K))XC=(X(L+1)-X(L))/(MI+1)             FN   57
      IF (XX.GE.X(K))XC=XCH                                             FN   58
      GO TO 2                                                           FN   59
    3 KK=N-1                                                            FN   60
C***  COMPUTE FIRST DERIVATIVE BY DIFFERENTIATION OF SPLINE FIT         FN   61
      CALL SPLINE(KK,Y,XX,AA)                                           FN   62
      L1=NS+1                                                           FN   63
      L2=KK-NS                                                          FN   64
      L3=MI+1                                                           FN   65
      II=0                                                              FN   66
      DO 4 I=L1,L2,L3                                                   FN   67
      II=II+1                                                           FN   68
      J=I                                                               FN   69
      IF (I.EQ.L2)J=J-1                                                 FN   70
      FP(II)=3.0D0*AA(1,J)*XX(I)**2+2.0D0*AA(2,J)*XX(I)+AA(3,J)         FN   71
    4 CONTINUE                                                          FN   72
C***  CHECK FOR SECOND DERIVATIVE REQUEST                               FN   73
      IF (ND.EQ.2) GO TO 5                                              FN   74
      GO TO 8                                                           FN   75
C***  COMPUTE ALL FIRST DERIVATIVES FOR SPLINE FIT                      FN   76
    5 DO 6 I=1,KK                                                       FN   77
      J=I                                                               FN   78
      IF (I.EQ.KK)J=J-1                                                 FN   79
    6 FPS(I)=3.0D0*AA(1,J)*XX(I)**2+2.0D0*AA(2,J)*XX(I)+AA(3,J)         FN   80
C***  COMPUTE SECOND DERIVATIVE BY DIFFERENTIATION OF SPLINED FIRST     FN   81
C***  DERIVATIVE                                                        FN   82
      CALL SPLINE(KK,FPS,XX,AA)                                         FN   83
      II=0                                                              FN   84
      DO 7 I=2,KK-2,L3                                                  FN   85
      II=II+1                                                           FN   86
      J=I                                                               FN   87
      IF (I.EQ.L2)J=J-1                                                 FN   88
      FPP(II)=3.0D0*AA(1,J)*XX(I)**2+2.0D0*AA(2,J)*XX(I)+AA(3,J)        FN   89
    7 CONTINUE                                                          FN   90
    8 RETURN                                                            FN   91
      END                                                               FN   92



      SUBROUTINE SEC4(L,K,XAX)                                          S4    1
C                                                                       S4    2
C***  SUBROUTINE SEC4 CONTROLS THE ANGLE-OF-ATTACK CALCULATIONS BY THE  S4    3
C***  DIFFERENTIAL EQUATION SOLUTION                                    S4    4
C                                                                       S4    5
      IMPLICIT REAL*8(A-H,O-Z)                                          S4    6
      COMMON TL(20),D(450,11),TH(450),A(100),B(100),F1(450),F2(450),F3(4  S4    7
     150),F4(450),F5(450),F6(450),F7(450),F8(450),TT,RHO,PI,G,JKS,H,JH,J  S4    8
     TH,JF,IERR                                                         S4    9
      COMMON /TEMP1/ST(450,4),PAR(6),PSL,TSL,IPAR                       S4   10
      COMMON /PAR8/GR,DAX                                               S4   11
      COMMON /BLK1/Z(450,5)                                             S4   12
      COMMON /LABX/IWB,IR                                               S4   13
      COMMON /TEMP2/F9(450),F10(450),F13(450),F14(450),AP(6),H(6)       S4   14
C                                                                       S4   15
      IF (L.GT.1) GO TO 2                                               S4   16
C***  INITIALIZE PARAMETERS AT FIRST POINT FOR ALL POINTS               S4   17
      ISE1=0                                                            S4   18
      IWB=JH                                                            S4   19
      IR=IERR                                                           S4   20
      DAX=XAX                                                           S4   21
      GR=G                                                              S4   22
      DO 1 I=1,K                                                        S4   23
      Z(I,1)=ST(I,4)                                                    S4   24
      Z(I,2)=F2(I)                                                      S4   25
      Z(I,3)=F3(I)                                                      S4   26
      Z(I,4)=F9(I)                                                      S4   27
    1 Z(I,5)=F6(I)                                                      S4   28
      T=F6(L)                                                           S4   29
      DY=(ST(L,4)-G*DSIN(Z(L,2))+XAX*Z(L,3)**2)/DCOS(Z(L,5))-Y*((Z(L,3)-  S4   30
     1Z(L,4))*DTAN(Z(L,5)))                                             S4   31
      GO TO 6                                                           S4   32
C***  COMPUTE TIME INCREMENT AND SET TIME TO PREVIOUS POINT             S4   33
    2 H=TH(L)-TH(L-1)                                                   S4   34
      J=L-1                                                             S4   35
      T=TH(J)                                                           S4   36
C***  EXACT PREDICTOR-CORRECTOR                                         S4   37
      CALL TRENOR(H,T,Y,DY,J,ISET)                                      S4   38
C***  CHECK FOR ERROR                                                   S4   39
      IERR=IR                                                           S4   40
      IF (IERR.NE.0) GO TO 4                                            S4   41
      GO TO 6                                                           S4   42
    4 WRITE (JWRITE,5)                                                  S4   43
    5 FORMAT (1X,/,10X,'AN ERROR OCCURRED IN THE PREDICTOR-CORRECTOR ROU S4   44
     1TINE',///)                                                        S4   45
      RETURN                                                            S4   46
C***  DEFINE NEW AIRSPEED AND ACCELERATION                              S4   47
    6 F6(L)=Y                                                           S4   48
      F8(L)=DY                                                          S4   49
      RETURN                                                            S4   50
      END                                                               S4   51



      SUBROUTINE TRENOR(H,XX,YY,DYY,J,ISET)                             TR    1
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C                                                                       TR   2
C***  SUBROUTINE TREMOR SOLVES A DIFFERENTIAL EQUATION BY PREDICTOR-    TR   3
C***  CORRECTOR METHODS                                                 TR   4
C                                                                       TR   5
      IMPLICIT REAL*8(A-H,O-Z)                                          TR   6
      EXTERNAL FHIDER                                                   TR   7
      COMMON /PARM/G,XAX                                                TR   8
      COMMON /PCR/DY(7),X(7),Y(7)                                       TR   9
      COMMON /LABR/JWRITE,IR                                            TR  10
      COMMON /CRCOEF/P,AC,A1,A2,A3,A4,A5,HH                             TR  11
      COMMON /BLK1/Z(450,5)                                             TR  12
      COMMON /BLK2/PH(5)                                                TR  13
C                                                                       TR  14
C***  INITIALIZE PARAMETERS FOR FF                                      TR  15
      DO 1 I=1,5                                                        TR  16
    1 PH(I)=Z(J,I)                                                      TR  17
C***  COMPUTE DERIVATIVE AT BEGINNING OF INTERVAL                       TR  18
      CALL FF(XX,YY,DYY)                                                TR  19
      DY(7)=DYY                                                         TR  20
C***  TEST FOR INITIALIZATION                                           TR  21
      IF (ISET)  2,2,4                                                  TR  22
C***  DEFINE VARIABLES INITIALLY                                        TR  23
    2 DO 3 I=1,7                                                        TR  24
      Y(I)=YY                                                           TR  25
      DY(I)=DYY                                                         TR  26
    3 X(I)=XX                                                           TR  27
C***  BEGIN RUNGE KUTTA                                                 TR  28
      K=1                                                               TR  29
      LK=6                                                              TR  30
      ISET=1                                                            TR  31
      GO TO 5                                                           TR  32
    4 IF (K.LT.7) K=K+1                                                 TR  33
      IF (K-7)  5,10,10                                                 TR  34
C***  DEFINE VARIABLES FOR FF                                           TR  35
    5 Y2=YY+0.5D0*H*DYY                                                 TR  36
      DO 6 I=1,5                                                        TR  37
    6 PH(I)=(Z(J,I)+Z(J+1,I))/2.0D0                                     TR  38
C***  COMPUTE DERIVATIVE AT INTERVAL MIDPOINT                           TR  39
      CALL FF(XX+0.5D0*H,Y2,DY2)                                        TR  40
      Y3=YY+0.5D0*H*DY2                                                 TR  41
C***  UPDATE DERIVATIVE AT INTERVAL MIDPOINT                            TR  42
      CALL FF(XX+0.5D0*H,Y3,DY3)                                        TR  43
C***  APPLY CORRECTIVE PROCEDURE FOR RUNGE KUTTA                        TR  44
      IF (DABS(DY2-DY3).LT.1.0D-15) GO TO 7                             TR  45
      P=-2.0D0*(DY3-DY2)/(DY2-DYY)/H                                    TR  46
      IF ((P*H).LT.1.0D-04) GO TO 7                                     TR  47
C***  COMPUTE 'STIFF-EQUATION' F COEFFICIENTS                           TR  48
      F0=0.0D0                                                          TR  49
      IF ((-P*H).LT.174.673D0.AND.(-P*H).GT.-180.218D0)F0=DEXP(-P*H)    TR  50
      F1=-(F0-1.0D0)/P/H                                                TR  51
      F2=-(F1-1.0D0)/P/H                                                TR  52
      F3=-(F2-0.5D0)/P/H                                                TR  53
      Y4=YY+H*(2.0D0*DY3*F2+DYY*(F1-2.0D0*F2)+DY2*P*H*F2)               TR  54
      AP=1.0D0                                                          TR  55
      IKP=0                                                             TR  56
      GO TO 8                                                           TR  57
C***  SET F COEFFICIENTS TO STANDARD ADAMS-BASHFORTH F COEFFICIENTS     TR  58
    7 F1=1.0D0                                                          TR  59
      F2=0.5D0                                                          TR  60
      F3=1.666666666666667D-1                                           TR  61
      P=0.0D0                                                           TR  62
      Y4=YY+H*DY3                                                       TR  63
C***  DEFINE VARIABLES FOR FF                                           TR  64
    8 DO 9 I=1,5                                                        TR  65
    9 PH(I)=Z(J+1,I)                                                    TR  66
C***  COMPUTE DERIVATIVE AT END OF INTERVAL                             TR  67
      CALL FF(XX+H,Y4,DY4)                                              TR  68
      B=-3.0D0*(DYY+P*YY)+2.0D0*(DY2+P*Y2)+2.0D0*(DY3+P*Y3)-(DY4+P*Y4)  TR  69
      C=4.0D0*((DYY+P*YY)-(DY2+P*Y2)-(DY3+P*Y3)+(DY4+P*Y4))             TR  70
      Y5=YY+H*(DYY*F1+B*F2+C*F3)                                        TR  71
C***  UPDATE DERIVATIVE AT END OF INTERVAL BY CORRECTOR                 TR  72
      CALL FF(XX+H,Y5,DY5)                                              TR  73
      GO TO 17                                                          TR  74
   10 DO 11 I=1,6                                                       TR  75
      Y(I)=Y(I+1)                                                       TR  76
      DY(I)=DY(I+1)                                                     TR  77
   11 X(I)=X(I+1)                                                       TR  78
      X(7)=X(6)+H                                                       TR  79
C***  CALL PREDICTOR TO PREDICT Y AT NEXT POINT                         TR  80
   12 DO 13 I=1,6                                                       TR  81
   13 CALL PHICEF(I)                                                    TR  82
      K=7                                                               TR  83
      LK=LK+1                                                           TR  84
      PPDCT=Y(1)+PHIDER(6,X(7),-1,1,0)-PHIDER(6,X(1),-1,1,0)            TR  85
C***  DEFINE VARIABLE FOR FF                                            TR  86
      DO 14 I=1,5                                                       TR  87
   14 PH(I)=Z(J+1,I)                                                    TR  88
C***  USING PREDICTED Y, COMPUTE ITS DERIVATIVE                         TR  89
      CALL FF(X(7),PRDCT,DY(7))                                         TR  90
      CALL PHICEF(7)                                                    TR  91
C***  GENERATE COEFFICIENTS NECESSARY FOR 'STIFF-EQUATION' CORRECTOR    TR  92
      CALL ECEF                                                         TR  93
C***  TEST FOR SUITABLE CORRECTOR                                       TR  94
      IF ((P*HH).LT.1.0D-02) GO TO 15                                   TR  95
C***  CORRECT Y BY 'STIFF-EQUATION' CORRECTOR                           TR  96
      CALL FNETH                                                        TR  97
      GO TO 16                                                          TR  98
C***  CORRECT Y BY MODIFIED TREANCE CORRECTOR                           TR  99
   15 Y(7)=Y(1)+PHIDER(7,X(7),-1,1,0)-PHIDER(7,X(1),-1,1,0)             TR 100
   16 YR=Y(7)                                                           TR 101
C***  COMPUTE FUNCTION DERIVATIVE BY FF                                 TR 102
      CALL FF(X(7),YR,DYR)                                              TR 103
      DY(7)=DYR                                                         TR 104
C***  TEST FOR POSSIBLE ERRORS                                          TR 105
      IF (IR.NE.0) RETURN                                               TR 106
C***  UPDATE PARAMETERS                                                 TR 107
   17 IF (LK.EQ.7) GO TO 20                                             TR 108
      IF (LK.GT.7) GO TO 19                                             TR 109
      DO 18 I=1,6                                                       TR 110
      Y(I)=Y(I+1)                                                       TR 111
      DY(I)=DY(I+1)                                                     TR 112
   18 X(I)=X(I+1)                                                       TR 113
      X(7)=X(6)+H                                                       TR 114
   19 Y(7)=YR                                                           TR 115
      DY(7)=DYR                                                         TR 116
      IF (K.EQ.6) GO TO 12                                              TR 117
   20 YY=Y(7)                                                           TR 118
      DYY=DY(7)                                                         TR 119
      XX=X(7)                                                           TR 120
      RETURN                                                            TR 121
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      END                                                               TR  122


      SUBROUTINE FF(T,Y,DY)
C                                                                       FF    1
C***  SUBROUTINE FF CALCULATES DERIVATIVES FOR ANGLE OF ATTACK          FF    2
C***  PREDICTIONS                                                       FF    3
C                                                                       FF    4
      IMPLICIT REAL*8(A-H,O-Z)                                          FF    5
      COMMON /PARM/G,XAX                                                FF    6
      COMMON /BLK2/X(5)                                                 FF    7
C                                                                       FF    8
      DY=(X(1)-G*DSIN(X(2))-XAX*X(3)**2)/DCOS(X(5))-Y*((X(3)-X(4))*DTAN(FF    9
     1X(5)))                                                            FF   10
      RETURN                                                            FF   11
      END                                                               FF   12
                                                                        FF   13


      SUBROUTINE PHICEF(I)
C                                                                       CP    1
C***  SUBROUTINE PHICEF COMPUTES COEFFICIENTS FOR NEWTON'S-FORWARD      CP    2
C***  INTERPOLATION SCHEME FOR NON-EQUIDISTANT INTERVALS FOR THE        CP    3
C***  FOLLOWING FUNCTION PHI:                                           CP    4
C***    PHI(X)=A(1)+A(2)*(X-X(1))+A(3)*(X-X(1))*(X-X(2))+...           CP    5
C***                 ...+A(I)*(X-X(1))*(X-X(2))*...*(X-X(I-1))+...     CP    6
C***                 ...+A(N)*(X-X(1))*(X-X(2))*...*(X-X(N-1)).        CP    7
C***  BY USING A RECURSION FORMULA, PHICEF CAN BE USED TO COMPUTE BOTH  CP    8
C***  DERIVATIVES AND ANTIDERIVATIVES OF PHI.  PHICEF MUST BE CALLED IN CP    9
C***  CONSECUTIVELY-INCREASING VALUES OF I FOR THE RECURSION FORMULA TO CP   10
C***  BE CORRECT.                                                       CP   11
C                                                                       CP   12
      IMPLICIT REAL*8(A-H,O-Z)                                          CP   13
      COMMON /AWRK/A(7),C(7,8)                                          CP   14
      COMMON /PC3/F(7),X(7),Y(7)                                        CP   15
      COMMON /LABX/JWRITE,IERR                                          CP   16
C                                                                       CP   17
      IF (I.LT.1.OR.I.GT.7) GO TO 8                                     CP   18
C***  TRANSLATE                                                         CP   19
      SVE=X(1)                                                          CP   20
      DO 1 J=1,I                                                        CP   21
    1 X(J)=X(J)-SVE                                                     CP   22
C***  CALCULATE THE C-COEFFICIENTS                                      CP   23
      J=1                                                               CP   24
C***  NOTE: C(I,1)=1 FOR ALL I                                          CP   25
      C(I,J)=1D0                                                        CP   26
    2 J=J+1                                                             CP   27
      IF (J.GT.I) GO TO 3                                               CP   28
      C(I,J)=X(I-1)*C(I-1,J-1)+C(I-1,J)                                 CP   29
      GO TO 2                                                           CP   30
C***  NOTE: C(I,I+1)=C FOR ALL I                                        CP   31
    3 C(I,I+1)=0D0                                                      CP   32
C***  CALCULATE A(I)                                                    CP   33
      A(I)=0D0                                                          CP   34
      DNM=1D0                                                           CP   35
      J=1                                                               CP   36
    4 IF (J.GT.I-1) GO TO 5                                             CP   37
      A(I)=A(I)+A(J)*DNM                                                CP   38
      DNM=DNM*(X(I)-X(J))                                               CP   39
      J=J+1                                                             CP   40
      GO TO 4                                                           CP   41
    5 A(I)=(F(I)-A(I))/DNM                                              CP   42
C***  RESET                                                             CP   43
      DO 6 J=1,I                                                        CP   44
    6 X(J)=X(J)+SVE                                                     CP   45
    7 RETURN                                                            CP   46
    8 IERR=1                                                            CP   47
      WRITE (JWRITE,9) I                                                CP   48
    9 FORMAT (1H ,'***PHICEF ERROR: I=',I3,' BUT 0<I<8 IS REQUIRED***') CP   49
      GO TO 7                                                           CP   50
      END                                                               CP   51
                                                                        CP   52


      SUBROUTINE LLSQAR(A,B,N,NA,NB,IA,IB,IDGT,WKAREA,IER,JWRITE)       LQ    1
C                                                                       LQ    2
C***  SUBROUTINE LLSQAR PERFORMS A LEAST SQUARES SOLUTION OF A OVER-    LQ    3
C***  DETERMINED SYSTEM OF LINEAR EQUATIONS                             LQ    4
C                                                                       LQ    5
      DIMENSION A(IA,1),B(IB,1),WKAREA(1)                               LQ    6
      REAL*8 SUM                                                        LQ    7
      REAL*8 A,B,WKAREA                                                 LQ    8
C                                                                       LQ    9
C***  INITIALIZE IER                                                    LQ   10
      IER=0                                                             LQ   11
C***  FIND THE PSEUDO-INVERSE OF MATRIX A                               LQ   12
      CALL LPSDOR(A,N,NA,IA,A,IDGT,WKAREA,IER,JWRITE)                   LQ   13
      IF (IER.NE.0) GO TO 5                                             LQ   14
C***  SOLVE THE EQUATION BY MULTIPLYING A-INVERSE AND B                 LQ   15
      DO 4 I=1,NB                                                       LQ   16
      DO 2 J=1,NA                                                       LQ   17
      CALL VXPZRO                                                       LQ   18
      DO 1 K=1,N                                                        LQ   19
      CALL VXPMUL(A(K,J),B(K,I))                                        LQ   20
    1 CONTINUE                                                          LQ   21
      CALL VXPSTO(SUM)                                                  LQ   22
      WKAREA(J)=SUM                                                     LQ   23
    2 CONTINUE                                                          LQ   24
C***  MOVE THE RESULTS INTO MATRIX B                                    LQ   25
      DO 3 J=1,NA                                                       LQ   26
      B(J,I)=WKAREA(J)                                                  LQ   27
    3 CONTINUE                                                          LQ   28
    4 CONTINUE                                                          LQ   29
      GO TO 6                                                           LQ   30
    5 IER=129                                                           LQ   31
      CALL UERTST(IER,6HLLSQAR,JWRITE)                                  LQ   32
    6 RETURN                                                            LQ   33
      END                                                               LQ   34


      SUBROUTINE LPSDOR(A,M,N,NA,IA,AINV,IDGT,WKAREA,IER,JWRITE)
C                                                                       PI    1
C***  SUBROUTINE LPSDOR FINDS THE PSEUDO-INVERSE OF A MATRIX            PI    2
C                                                                       PI    3
      DIMENSION A(IA,1),AINV(IA,1),WKAREA(M,1)                          PI    4
      REAL*8 A,AINV,WKAREA,BIGA,AEN,ZERO,ETA                            PI    5
      REAL*8 SUM,DETA                                                   PI    6
C                                                                       PI    7
                                                                        PI    8
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C***  INITIALIZE IER                                                    PI    9
      IER=0                                                             PI   10
      NP1=N+1                                                           PI   11
      NP2=N+2                                                           PI   12
      NP3=N+3                                                           PI   13
C***  FIND THE LARGEST ELEMENT OF A                                     PI   14
      BIGA=0.D0                                                         PI   15
      DO 1 I=1,N                                                        PI   16
      DO 1 II=1,N                                                       PI   17
      IF (BIGA.GE.DABS(A(I,II))) GO TO 1                                PI   18
      BIGA=DABS(A(I,II))                                                PI   19
    1 CONTINUE                                                          PI   20
      ANN=N*N                                                           PI   21
      ETA=DSQRT(ANN)/(10.**IDGT)*BIGA                                   PI   22
C***  CALCULATE THE SINGULAR VALUE DECOMPOSITION OF A                   PI   23
      CALL ISVALR(A,N,N,IA,N,1,WKAREA(1,N+4),WKAREA(1,NP1),AINV,WKAREA) PI   24
      DO 2 I=1,N                                                        PI   25
    2 WKAREA(I,NP2)=WKAREA(I,NP1)                                       PI   26
C***  SORT THE SINGULAR VALUES ARRAY INTO ASCENDING SEQUENCE BY ABSOLUTE PI   27
C***  VALUE                                                             PI   28
      CALL VSCRTH(WKAREA(1,NP2),N)                                      PI   29
      DETA=ETA**2                                                       PI   30
      CALL VKPZRO                                                       PI   31
C***  COMPARE SINGULAR VALUES AND ETA                                   PI   32
      DO 3 I=1,N                                                        PI   33
      IP=I                                                              PI   34
      CALL VKPMUL(WKAREA(I,NP2),WKAREA(I,NP2))                          PI   35
      CALL VKPSTO(SUM)                                                  PI   36
      IF (SUM.GT.DETA) GO TO 4                                          PI   37
    3 CONTINUE                                                          PI   38
      IER=129                                                           PI   39
      GO TO 15                                                          PI   40
    4 IP=IP-1                                                           PI   41
      IF (IP.NE.0) GO TO 5                                              PI   42
      ZERO=0.D0                                                         PI   43
      GO TO 6                                                           PI   44
    5 ZERO=WKAREA(IP,NP2)                                               PI   45
    6 DO 10 I=1,N                                                       PI   46
      IF (WKAREA(I,NP1).LE.ZERO) GO TO 8                                PI   47
      DO 7 J=1,N                                                        PI   48
    7 WKAREA(J,I)=WKAREA(J,I)/WKAREA(I,NP1)                             PI   49
      GO TO 10                                                          PI   50
C***  SET WKAREA(J,I)=0.0, FOR J=1,...,N, IF WKAREA(I,NP1).LE.ZERO      PI   51
    8 DO 9 J=1,N                                                        PI   52
    9 WKAREA(J,I)=0.0                                                   PI   53
   10 CONTINUE                                                          PI   54
      DO 14 I=1,N                                                       PI   55
      DO 12 J=1,N                                                       PI   56
      CALL VKPZRO                                                       PI   57
      DO 11 K=1,N                                                       PI   58
   11 CALL VKPMUL(WKAREA(J,K),AINV(I,K))                                PI   59
      CALL VKPSTO(SUM)                                                  PI   60
   12 WKAREA(J,NP3)=SUM                                                 PI   61
C***  MOVE THE RESULTS INTO MATRIX AINV                                 PI   62
      DO 13 J=1,N                                                       PI   63
   13 AINV(I,J)=WKAREA(J,NP3)                                           PI   64
   14 CONTINUE                                                          PI   65
      GO TO 16                                                          PI   66
   15 CALL UERTST(IER,6HLPSDOB,JWRITE)                                  PI   67
   16 RETURN                                                            PI   68
      END                                                               PI   69


      SUBROUTINE LSVALR(A,M,N,IA,IV,ISW,WKAREA,U,W,V)                   SV    1
C                                                                       SV    2
C***  SUBROUTINE LSVALR DETERMINES THE SINGULAR VALUE DECOMPOSITION OF A SV    3
C***  MATRIX                                                            SV    4
C                                                                       SV    5
      DIMENSION A(IA,1),U(IA,1),V(IV,1),Q(1),WKAREA(1)                  SV    6
      REAL*8A,WKAREA,Q,U,V,EPS,TOL                                      SV    7
      REAL*8F,G,H,X,Y,Z,C,S,HR,GR,DPS,ONE,ZERO                          SV    8
      DATA TOL/Z3D100000000000000/,DPS/Z3410000000000000/               SV    9
      DATA ONE/1.0D0/,ZERO/0.0D0/                                       SV   10
C                                                                       SV   11
      EPS=DPS                                                           SV   12
      DO 1 I=1,M                                                        SV   13
      DO 1 J=1,N                                                        SV   14
    1 U(I,J)=A(I,J)                                                     SV   15
C***  HOUSEHOLDER'S REDUCTION TO BIDIAGONAL FORM                        SV   16
      X=0.D0                                                            SV   17
      G=0.D0                                                            SV   18
      DO 17 I=1,N                                                       SV   19
      WKAREA(I)=G                                                       SV   20
      CALL VKPZRO                                                       SV   21
      L=I+1                                                             SV   22
      DO 2 J=I,M                                                        SV   23
    2 CALL VKPMUL(U(J,I),U(J,I))                                        SV   24
      CALL VKPSTO(S)                                                    SV   25
      IF (S.GE.TOL) GO TO 3                                             SV   26
      G=0.D0                                                            SV   27
      GO TO 7                                                           SV   28
    3 F=U(I,I)                                                          SV   29
      G=-DSQRT(S)                                                       SV   30
      IF (F.LT.0.D0)G=-G                                                SV   31
      H=F*G-S                                                           SV   32
      HR=1.0/H                                                          SV   33
      U(I,I)=F-G                                                        SV   34
      IF (L.GT.N) GO TO 7                                               SV   35
      DO 6 J=L,N                                                        SV   36
      CALL VKPZRO                                                       SV   37
      DO 4 K=I,M                                                        SV   38
    4 CALL VKPMUL(U(K,I),U(K,J))                                        SV   39
      CALL VKPSTO(S)                                                    SV   40
      F=S*HR                                                            SV   41
      DO 5 K=I,M                                                        SV   42
    5 U(K,J)=U(K,J)+F*U(K,I)                                            SV   43
    6 CONTINUE                                                          SV   44
    7 Q(I)=G                                                            SV   45
      CALL VKPZRO                                                       SV   46
      IF (L.GT.N) GO TO 9                                               SV   47
      DO 8 J=L,N                                                        SV   48
    8 CALL VKPMUL(U(I,J),U(I,J))                                        SV   49
      CALL VKPSTO(S)                                                    SV   50
    9 IF (S.GE.TOL) GO TO 10                                            SV   51
      G=0.D0                                                            SV   52
      GO TO 16                                                          SV   53
   10 IF (I.LT.N) F=U(I,I+1)                                            SV   54
      G=-DSQRT(S)                                                       SV   55
                                                                        SV   56
```

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```
      IF (F.LT.0.D0)G=-G
      H=F*G-S
      HH=1.0/H
      IF (I.LT.N)U(I,I+1)=F-G
      IF (L.GT.N) GO TO 12
      DO 11 J=L,N
   11 WKAREA(J)=U(I,J)*HH
   12 IF (L.GT.N) GO TO 16
      DO 15 J=L,N
      CALL VIPZRO
      IF (L.GT.N) GO TO 15
      DO 13 K=L,N
   13 CALL VIPMUL(U(J,K),U(I,K))
      CALL VIPSTO(S)
      DO 14 K=L,N
   14 U(J,K)=U(J,K)+S*WKAREA(K)
   15 CONTINUE
   16 Y=DABS(Q(I))+DABS(WKAREA(I))
      IF (Y.GT.X) X=Y
   17 CONTINUE
C***  ACCUMULATION OF RIGHT HAND TRANSFORMATIONS
      IF (ISW.EQ.0) GO TO 37
      DO 25 I=1,N
      II=N-I+1
      IF (G.EQ.C.D0) GO TO 22
      IF (L.GT.N) GO TO 24
      H=U(II,II+1)*G
      HH=1.0/H
      DO 18 J=L,N
   18 V(J,II)=U(II,J)*HH
      DO 21 J=L,N
      CALL VIPZRO
      DO 19 K=L,N
   19 CALL VIPMUL(U(II,K),V(K,J))
      CALL VIPSTO(S)
      DO 20 K=L,N
   20 V(K,J)=V(K,J)+S*V(K,II)
   21 CONTINUE
   22 IF (L.GT.N) GO TO 24
      DO 23 J=L,N
      V(J,II)=0.D0
   23 V(II,J)=0.D0
   24 V(II,II)=1.000
      G=WKAREA(II)
   25 L=II
C***  ACCUMULATION OF LEFT HAND TRANSFORMATIONS
      DO 36 I=1,N
      II=N-I+1
      LL=II+1
      G=Q(II)
      IF (LL.GT.N) GO TO 27
      DO 26 J=LL,N
   26 U(II,J)=0.D0
   27 IF (G.EQ.0.D0) GO TO 33
      H=U(II,II)*G
      HH=1.0/H
      IF (LL.GT.N) GO TO 31
      DO 30 J=LL,N
      CALL VIPZRO
      DO 28 K=LL,N
   28 CALL VIPMUL(U(K,II),U(K,J))
      CALL VIPSTO(S)
      F=S*HH
      DO 29 K=II,N
   29 U(K,J)=U(K,J)+F*U(K,II)
   30 CONTINUE
   31 GH=1.0/G
      DO 32 J=II,N
   32 U(J,II)=U(J,II)*GH
      GO TO 35
   33 DO 34 J=II,N
   34 U(J,II)=0.D0
   35 U(II,II)=U(II,II)+1.000
   36 CONTINUE
C***  DIAGONALIZATION OF THE BIDIAGONAL FORM
   37 EPS=EPS*X
      DO 57 K=1,N
      KK=N-K+1
C***  TEST F SPLITTING
   38 DO 39 L=1,KK
      LL=KK-L+1
      IF (DABS(WKAREA(LL)).LE.EPS) GO TO 45
      IF (LL.EQ.1) GO TO 45
      IF (DABS(Q(LL-1)).LE.EPS) GO TO 40
   39 CONTINUE
C***  CANCELLATION OF WKAREA(L) IF LL.GT.1
   40 C=0.D0
      S=1.0D0
      L1=LL-1
      IF (KK.LT.LL) GO TO 45
      DO 44 I=LL,KK
      F=S*WKAREA(I)
      WKAREA(I)=C*WKAREA(I)
      IF (DABS(F).LE.EPS) GO TO 45
      G=Q(I)
      Q(I)=DSQRT(F*F+G*G)
      H=Q(I)
      IF (H.NE.ZERO) GO TO 41
      C=ZERO
      S=ONE
      GO TO 42
   41 C=G/H
      S=-F/H
   42 IF (ISW.EQ.0) GO TO 44
      DO 43 J=1,N
      Y=U(J,L1)
      Z=U(J,I)
      U(J,L1)=Y*C+Z*S
   43 U(J,I)=-Y*S+Z*C
   44 CONTINUE
C***  TEST F CONVERGENCE
   45 Z=Q(KK)
      IF (LL.EQ.KK) GO TO 55
C***  SHIFT FROM BOTTOM 2X2 MINOR
      X=Q(LL)
      IF (KK.GT.1)Y=Q(KK-1)
      IF (KK.GT.1)G=WKAREA(KK-1)
      H=WKAREA(KK)
      F=((Y-Z)*(Y+Z)+(G-H)*(G+H))/(2.D0*H*Y)
      G=DSQRT(F*F+ONE)
```

```
      IF (F.LT.0.EQ) F=((X-Z)*(X+Z)+W*(X/(F-G)-H))/X
      IF (F.GE.0.EC) F=((X-Z)*(X+Z)+W*(X/(F+G)-H))/X
C***  NEXT CP TRANSFORMATION
      C=1.CDC
      S=1.0D0
      L2=LL+1
      IF (KK.LT.L2) GO TO 54
      DO 53 I=L2,KK
      G=WKAREA(I)
      Y=C(I)
      H=S*G
      G=C*G
      Z=DSQRT(F*F+H*H)
      WKAREA(I-1)=Z
      IF (Z.NE.ZERC) GC TC 46
      C=ZERC
      S=CNE
      GC TC 47
   46 C=F/Z
      S=H/Z
   47 F=X*C+G*S
      G=-X*S+G*C
      H=Y*S
      Y=Y*C
      IF (ISW.EQ.0) GO TO 49
      DO 48 J=1,N
      X=V(J,I-1)
      Z=V(J,I)
      V(J,I-1)=X*C+Z*S
   48 V(J,I)=-X*S+Z*C
   49 Z=DSQRT(F*F+H*H)
      Q(I-1)=Z
      IF (Z.NE.ZERO) GO TO 50
      C=ZERC
      S=ONE
      GC TC 51
   50 C=F/Z
      S=H/Z
   51 F=C*G+S*Y
      X=-S*G+C*Y
      IF (ISW.EQ.0) GO TO 53
      DO 52 J=1,N
      Y=U(J,I-1)
      Z=U(J,I)
      U(J,I-1)=Y*C+Z*S
   52 U(J,I)=-Y*S+Z*C
   53 CONTINUE
   54 WKAREA(LL)=ZERO
      WKAREA(KK)=F
      Q(KK)=X
      GO TO 38
C***  CONVERGENCE
   55 IF (Z.GE.ZERC) GO TO 57
      Q(KK)=-Z
      IF (ISW.EQ.0) GO TO 57
      DO 56 J=1,N
   56 V(J,KK)=-V(J,KK)
   57 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE UERTST(IER,NAME,JWRITE)                                  UR  1
C                                                                         UR  2
C***  SUBROUTINE UERTST GENERATES ERROR MESSAGES                          UR  3
C                                                                         UR  4
      DIMENSION ITYP(5,4),IBIT(4)                                         UR  5
      INTEGER*2 NAME(3)                                                   UR  6
      INTEGER WARN,WARF,TERM,JWRITE                                       UR  7
      EQUIVALENCE (IBIT(1),WARN),(IBIT(2),WARF),(IBIT(3),TERM)            UR  8
      DATA ITYP/'WARN','ING ',' ',' ',' ',' ','WARN','ING(','WITH',      UR  9
     1' FIX',')  ','TERM','INAL',' ',' ',' ',' ','NON-','DEFI','NE      UR 10
     1D ',' ',' ',' '/,IBIT/32,64,128,0/                                  UR 11
C                                                                         UR 12
      IER2=IER                                                            UR 13
      IF (IER2.GE.WARN) GO TO 1                                           UR 14
C***  UNDEFINED                                                           UR 15
      IER1=4                                                              UR 16
      GO TO 4                                                             UR 17
    1 IF (IER2.LT.TERM) GC TO 2                                           UR 18
C***  TERMINAL                                                            UR 19
      IER1=3                                                              UR 20
      GO TO 4                                                             UR 21
    2 IF (IER2.LT.WARF) GO TO 3                                           UR 22
C***  WARNING (WITH FIX)                                                  UR 23
      IER1=2                                                              UR 24
      GO TO 4                                                             UR 25
C***  WARNING                                                             UR 26
    3 IER1=1                                                              UR 27
C***  EXTRACT 'N'                                                         UR 28
    4 IER2=IER2-IBIT(IER1)                                                UR 29
C***  PRINT ERROR MESSAGE                                                 UR 30
      WRITE (JWRITE,5) (ITYP(I,IER1),I=1,5),NAME,IER2,IER                 UR 31
    5 FORMAT (1H,/,1H,'ERROR MESSAGE FROM UERTST',2X,5A4,4X,3A2,4X,I2,2X  UR 32
     1,'IER= ',I3)                                                        UR 33
      RETURN                                                              UR 34
      END                                                                 UR 35
```

```
      SUBROUTINE VSORTH(A,LA)                                             VS  1
C                                                                         VS  2
C***  SUBROUTINE VSORTH SORTS ARRAYS BY ABSOLUTE VALUE                    VS  3
C                                                                         VS  4
      DIMENSION A(1),IU(21),IL(21)                                        VS  5
      REAL*8A,T,TT                                                        VS  6
C                                                                         VS  7
C***  FIND ABSOLUTE VALUES OF ARRAY A                                     VS  8
      DO 1 I=1,LA                                                         VS  9
      IF (A(I).LT.0.0)A(I)=-A(I)                                          VS 10
    1 CONTINUE                                                            VS 11
C                                                                         VS 12
      ENTRY VSORTA(A,LA)                                                  VS 13
C                                                                         VS 14
C***  ENTRY VSORTA SORTS ARRAYS BY ALGEBRAIC VALUE                        VS 15
C                                                                         VS 16
      M=1                                                                 VS 17
      I=1                                                                 VS 18
      J=LA                                                                VS 19
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      R=.375                                                            VS   20
    2 IF (I.EQ.J) GO TO 11                                              VS   21
      IF (R.GT..5898437) GO TO 4                                        VS   22
      R=R+3.90625E-2                                                    VS   23
      GO TO 5                                                           VS   24
    4 R=R-.21875                                                        VS   25
    5 K=I                                                               VS   26
C***  SELECT A CENTRAL ELEMENT OF THE ARRAY AND SAVE IT IN LOCATION T    VS   27
      IJ=I+(J-I)*R                                                      VS   28
      T=A(IJ)                                                           VS   29
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAT T, INTERCHANGE WITH T    VS   30
      IF (A(I).LE.T) GO TO 6                                            VS   31
      A(IJ)=A(I)                                                        VS   32
      A(I)=T                                                            VS   33
      T=A(IJ)                                                           VS   34
    6 L=J                                                               VS   35
C***  IF LAST ELEMENT OF ARRAY IS LESS THAN T, INTERCHANGE WITH T       VS   36
      IF (A(J).GE.T) GO TO 8                                            VS   37
      A(IJ)=A(J)                                                        VS   38
      A(J)=T                                                            VS   39
      T=A(IJ)                                                           VS   40
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAN T, INTERCHANGE WITH T    VS   41
      IF (A(I).LE.T) GO TO 8                                            VS   42
      A(IJ)=A(I)                                                        VS   43
      A(I)=T                                                            VS   44
      T=A(IJ)                                                           VS   45
      GO TO 8                                                           VS   46
    7 TT=A(L)                                                           VS   47
      A(L)=A(K)                                                         VS   48
      A(K)=TT                                                           VS   49
C***  FIND AN ELEMENT IN SECOND HALF OF ARRAY WHICH IS SMALLER THAN T    VS   50
    8 L=L-1                                                             VS   51
      IF (A(L).GT.T) GO TO 8                                            VS   52
C***  FIND AN ELEMENT IN FIRST HALF OF ARRAY WHICH IS GREATER THAN T     VS   53
    9 K=K+1                                                             VS   54
      IF (A(K).LT.T) GO TO 9                                            VS   55
C***  INTERCHANGE THESE ELEMENTS                                        VS   56
      IF (K.LE.L) GO TO 7                                               VS   57
C***  SAVE UPPER AND LOWER SUBSCRIPTS OF THE ARRAY YET TO BE SORTED     VS   58
      IF (L-I.LE.J-K) GO TO 10                                          VS   59
      IL(M)=I                                                           VS   60
      IU(M)=L                                                           VS   61
      I=K                                                               VS   62
      M=M+1                                                             VS   63
      GO TO 12                                                          VS   64
   10 IL(M)=K                                                           VS   65
      IU(M)=J                                                           VS   66
      J=L                                                               VS   67
      M=M+1                                                             VS   68
      GO TO 12                                                          VS   69
C***  BEGIN AGAIN ON ANOTHER PORTION OF UNSORTED ARRAY                  VS   70
   11 M=M-1                                                             VS   71
      IF (M.EQ.0) RETURN                                                VS   72
      I=IL(M)                                                           VS   73
      J=IU(M)                                                           VS   74
   12 IF (J-I.GE.11) GO TO 5                                            VS   75
      IF (I.EQ.1) GO TO 2                                               VS   76
      I=I-1                                                             VS   77
   13 I=I+1                                                             VS   78
      IF (I.EQ.J) GO TO 11                                              VS   79
      T=A(I+1)                                                          VS   80
      IF (A(I).LE.T) GO TO 13                                           VS   81
      K=I                                                               VS   82
   14 A(K+1)=A(K)                                                       VS   83
      K=K-1                                                             VS   84
      IF (T.LT.A(K)) GO TO 14                                           VS   85
      A(K+1)=T                                                          VS   86
      GO TO 13                                                          VS   87
      END                                                               VS   88


      SUBROUTINE MADD(A,B,N,M,MS)                                       MA    1
C                                                                       MA    2
C***  SUBROUTINE MADD ADDS TWO MATRICES                                 MA    3
C                                                                       MA    4
      IMPLICIT REAL*8(A-H,O-Z)                                          MA    5
      DIMENSION A(1),B(1)                                               MA    6
C                                                                       MA    7
      NN=N*M                                                            MA    8
C***  CHECK FOR UPPER TRIANGULAR STORAGE MODE                           MA    9
      IF (MS.EQ.1)NN=N*(N+1)/2                                          MA   10
C***  SUM THE MATRICES ELEMENT BY ELEMENT                               MA   11
      DO 1 I=1,NN                                                       MA   12
    1 A(I)=A(I)+B(I)                                                    MA   13
      RETURN                                                            MA   14
      END                                                               MA   15


      SUBROUTINE MSTR(A,B,N,MSA,MSB)                                    MS    1
C                                                                       MS    2
C***  SUBROUTINE MSTR CHANGES THE STORAGE MODE OF THE MATRIX            MS    3
C                                                                       MS    4
      IMPLICIT REAL*8(A-H,O-Z)                                          MS    5
      DIMENSION A(1),B(1)                                               MS    6
C                                                                       MS    7
      DO 5 I=1,N                                                        MS    8
      DO 5 J=1,N                                                        MS    9
C***  IF MATRIX B IS GENERAL, FORM ELEMENT                              MS   10
      IF (MSB)  1,2,1                                                   MS   11
C***  IF IN LOWER TRIANGLE OF SYMMETRIC OR DIAGONAL B, BYPASS           MS   12
    1 IF (I-J)  2,2,5                                                   MS   13
    2 CALL ICC(I,J,IB,N,N,MSB)                                          MS   14
C***  IF IN UPPER AND OFF-DIAGONAL OF DIAGONAL B, BYPASS                MS   15
      IF (IB)  5,5,3                                                    MS   16
C***  FORM B(I,J)                                                       MS   17
    3 B(IB)=0.0D0                                                       MS   18
      CALL ICC(I,J,IA,N,N,MSA)                                          MS   19
C***  IF THERE IS NO A(I,J), LEAVE B(I,J) AT 0.0                        MS   20
      IF (IA)  5,5,4                                                    MS   21
    4 B(IB)=A(IA)                                                       MS   22
    5 CONTINUE                                                          MS   23
      RETURN                                                            MS   24
      END                                                               MS   25


      SUBROUTINE FILTER(A,B,WCUT,NF)                                    FL    1
C                                                                       FL    2
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C***  SUBROUTINE FILTER IS A LOW-PASS FILTER USED TO REDUCE HIGH NOISE   FL   3
C                                                                       FL   4
      IMPLICIT REAL*8(A-H,O-Z)                                          FL   5
      DIMENSION A(MP1),B(MP1)                                           FL   6
C                                                                       FL   7
C***  INTIALIZE PARAMETERS                                              FL   8
      PI=3.14159265358979300                                            FL   9
      X=WCUT                                                            FL  10
      XXX=3.0D0/2.0D0*X                                                 FL  11
      DO 4 N=1,MP1                                                      FL  12
C***  TEST FOR ARGUMENT RANGE FOR FILTERING                             FL  13
      XX=N                                                              FL  14
      IF (XX.GE.X.AND.XX.LE.XXX) GO TO 1                                FL  15
      GO TO 2                                                           FL  16
    1 A(N)=A(N)*(DCOS(PI*(XX-X)/X))**2                                  FL  17
      B(N)=B(N)*(DCOS(PI*(XX-X)/X))**2                                  FL  18
    2 IF (XX.GT.XXX) GO TO 3                                            FL  19
      GO TO 4                                                           FL  20
    3 A(N)=0.0D0                                                        FL  21
      B(N)=C.CD0                                                        FL  22
    4 CONTINUE                                                          FL  23
      RETURN                                                            FL  24
      END                                                               FL  25



      SUBROUTINE SPLINE(N,Y,X,AA)                                       SP   1
C                                                                       SP   2
C***  SUBROUTINE SPLINE FINDS THE RELATIONSHIP BETWEEN FUNCTION VALUES  SP   3
C***  AND ALLOWS THE CALCULATION OF DERIVATIVES.                        SP   4
C***     REFERENCE FOR THIS METHOD IS:                                  SP   5
C***     THE THEORY OF SPLINES AND THEIR APPLICATIONS                   SP   6
C***     J.H. AHLBERG, ET AL, ACADEMIC PRESS, NEW YORK, 1967            SP   7
C                                                                       SP   8
      IMPLICIT REAL*8(A-H,O-Z)                                          SP   9
      DIMENSION AA(4,N),X(N),Y(N),H(1827),Q(1827),U(1827)               SP  10
C                                                                       SP  11
      NM1=N-1                                                           SP  12
      DO 1 I=1,NM1                                                      SP  13
    1 H(I)=X(I+1)-X(I)                                                  SP  14
C***  MODIFIED LEFT-HAND END CONDITION THAT ALLEVIATES THE NEED TO       SP  15
C***  SPECIFY THE X-DERIVATIVE OF Y AT POINT 1                          SP  16
      Q(1)=-31.0D0/32.0D0                                               SP  17
      H1=H(1)                                                           SP  18
      H2=H(2)                                                           SP  19
      H3=H(3)                                                           SP  20
      U(1)=Y(1)*(32.0D0*H1*42.0D0*H2*21.0D0*H3)/(H1*H2)/(H1*H2*H3)-Y(2)* SP  21
     1(11.0D0*H1*42.0D0*H2*21.0D0*H3)/(H2*H3)/H2*Y(3)*H1*(11.0D0*H1*21.0 SP  22
     1D0*(H2*H3))/(H1*H2)/H2/H3-Y(4)*H1*(11.0D0*H1*21.0D0*H2)/(H2*H3)/(H SP  23
     11*H2*H3)/H3                                                       SP  24
C***  GENERATE INTERNAL U(I) BY ALGORITHMM GIVEN BY AHLBERG             SP  25
      U(1)=3.0D0*U(1)/H1/16.0D0                                         SP  26
      HM=H(1)                                                           SP  27
      YY=Y(2)                                                           SP  28
      YM=Y(1)                                                           SP  29
      DO 2 I=2,NM1                                                      SP  30
      HH=H(I)                                                           SP  31
      YP=Y(I+1)                                                         SP  32
      D=3.0D0*((YP-YY)/HH-(YY-YM)/HM)/(HM+HH)                           SP  33
      C=0.5D0*HH/(HH+HM)                                                SP  34
      A=0.5D0-C                                                         SP  35
      E=A*Q(I-1)+1.0D0                                                  SP  36
      Q(I)=-C/E                                                         SP  37
      U(I)=(D-A*U(I-1))/E                                               SP  38
      HM=HH                                                             SP  39
      YM=YY                                                             SP  40
    2 YY=YP                                                             SP  41
C***  MODIFIED RIGHT-HAND END CONDITION THAT ALLEVIATES THE NEED TO      SP  42
C***  SPECIFY THE X-DERIVATIVE OF Y AT POINT N                          SP  43
      A=31.0D0/32.0D0                                                   SP  44
      E=A*Q(N-1)+1.0D0                                                  SP  45
      H1=H(NM1)                                                         SP  46
      H2=H(NM1-1)                                                       SP  47
      H3=H(NM1-2)                                                       SP  48
      D=Y(N)*(32.0D0*H1+42.0D0*H2+21.0D0*H3)/(H1*H2)/(H1+H2+H3)-Y(NM1)*( SP  49
     111.0D0*H1+42.0D0*H2+21.0D0*H3)/(H2+H3)/H2*X(NM1-1)*H1*(11.0D0*H1+2 SP  50
     11.0D0*(H2+H3))/(H1*H2)/H2/H3-Y(NM1-2)*H1*(11.0D0*H1+21.0D0*H2)/(H2 SP  51
     1+H3)/(H1+H2+H3)/H3                                                SP  52
      D=3.0D0*D/H1/16.0D0                                               SP  53
      U(N)=(D-A*U(N-1))/E                                               SP  54
C***  SOLVE FOR THE SPLINE COEFFICIENTS CORRESPONDING TO AHLBERG M(0) TO SP  55
C***  M(N) AND STORE THEM IN THE U(I)                                   SP  56
      DO 3 J=1,NM1                                                      SP  57
      I=N-J                                                             SP  58
    3 U(I)=Q(I)*U(I+1)+U(I)                                             SP  59
C***  FORM THE SPLINE COEFFICIENTS FOR THE CONVENTIONAL FORM OF A CUBIC  SP  60
C***  POLYNOMIAL FROM THE U(I)                                          SP  61
      UU=U(1)                                                           SP  62
      XX=X(1)                                                           SP  63
      YY=Y(1)                                                           SP  64
      DO 4 I=1,NM1                                                      SP  65
      UP=U(I+1)                                                         SP  66
      XP=X(I+1)                                                         SP  67
      YP=Y(I+1)                                                         SP  68
      HH=H(I)                                                           SP  69
      AA(1,I)=(UP-UU)/HH/6.0D0                                          SP  70
      AA(2,I)=0.5D0*(XP*UU-XX*UP)/HH                                    SP  71
      AA(3,I)=0.5D0*(UP*XX*XX-UU*XP*XP)/HH+(UU-UP)*HH/6.0D0*(YP-YY)/HH  SP  72
      AA(4,I)=(UU*XP*XP*XP-UP*XX*XX*XX)/HH/6.0D0+(UP*XX-UU*XP)*HH/6.0D0* SP  73
     1(YY*XP-YP*XX)/HH                                                  SP  74
      XX=XP                                                             SP  75
      UU=UP                                                             SP  76
    4 YY=YP                                                             SP  77
      RETURN                                                            SP  78
      END                                                               SP  79



      SUBROUTINE PCEF                                                   PC   1
C                                                                       PC   2
C***  SUBROUTINE PCEF CALCULATES THE COEFFICIENTS FOR THE 'STIFF-       PC   3
C***  EQUATION' CORRECTOR                                               PC   4
C                                                                       PC   5
      IMPLICIT REAL*8(A-Z)                                              PC   6
      REAL*8 TOL/1.0D-2/                                                PC   7
      COMMON /PCR/DY0,DY1,DY2,DY3,DY4,DY5,DY6,X0,X1,X2,X3,X4,X5,X6,Y0,Y1 PC   8
     1,Y2,Y3,Y4,Y5,Y6                                                   PC   9
      COMMON /CRCOEF/E,A0,A1,A2,A3,A4,A5,H                              PC  10
C                                                                       PC  11
C***  DEFINE DIFFERENCES                                                PC  12
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      T(X)=X-X0                                                          PC   13
      W(T)=Y-Y0                                                          PC   14
      V(DY)=DY-DY0                                                       PC   15
C***  CALCULATE X-DIFFERENCES                                            PC   16
      T0=T(X0)                                                           PC   17
      T1=T(X1)                                                           PC   18
      T2=T(X2)                                                           PC   19
      T3=T(X3)                                                           PC   20
      T4=T(X4)                                                           PC   21
      T5=T(X5)                                                           PC   22
      T6=T(X6)                                                           PC   23
C***  CALCULATE Y-DIFFERENCES RELATIVE TO Y0                             PC   24
      W0=W(X0)                                                           PC   25
      W1=W(T1)                                                           PC   26
      W2=W(T2)                                                           PC   27
      W3=W(T3)                                                           PC   28
      W4=W(T4)                                                           PC   29
      W5=W(T5)                                                           PC   30
      W6=W(T6)                                                           PC   31
C***  CALCULATE DY-DIFFERENCES RELATIVE TO DY0                           PC   32
      V0=V(DY0)                                                          PC   33
      V1=V(DY1)                                                          PC   34
      V2=V(DY2)                                                          PC   35
      V3=V(DY3)                                                          PC   36
      V4=V(DY4)                                                          PC   37
      V5=V(DY5)                                                          PC   38
      V6=V(DY6)                                                          PC   39
C***  EQUATION 1                                                         PC   40
      B0=V1/T1                                                           PC   41
      B2=-T1                                                             PC   42
      B3=B2*T1                                                           PC   43
      B4=B3*T1                                                           PC   44
      B5=B4*T1                                                           PC   45
      B6=W1/T1                                                           PC   46
C***  EQUATION 2                                                         PC   47
      C=T2*(B2+T2)                                                       PC   48
      C0=(V2-T2*B0)/C                                                    PC   49
      C3=-(T2*(B3+T2*T2))/C                                              PC   50
      C4=-(T2*(B4+T2*T2*T2))/C                                           PC   51
      C5=-(T2*(B5+T2*T2*T2*T2))/C                                        PC   52
      C6=(W2-T2*B6)/C                                                    PC   53
C***  UPDATE EQUATION 2                                                  PC   54
      D0=B2*C0+B0                                                        PC   55
      D3=B2*C3+B3                                                        PC   56
      D4=B2*C4+B4                                                        PC   57
      D5=B2*C5+B5                                                        PC   58
      D6=B2*C6+B6                                                        PC   59
C***  EQUATION 3                                                         PC   60
      E=T3*(D3+T3*(C3+T3))                                               PC   61
      E0=(V3-(T3*(D0+T3*C0)))/E                                          PC   62
      E4=-(T3*(D4+T3*(C4+T3*T3)))/E                                      PC   63
      E5=-(T3*(D5+T3*(C5+T3*T3*T3)))/E                                   PC   64
      E6=(W3-T3*(D6+T3*C6))/E                                            PC   65
C***  UPDATE EQUATION 3                                                  PC   66
      F0=D3*E0+D0                                                        PC   67
      F4=D3*E4+D4                                                        PC   68
      F5=D3*E5+D5                                                        PC   69
      F6=D3*E6+D6                                                        PC   70
      G0=C3*E0+C0                                                        PC   71
      G4=C3*E4+C4                                                        PC   72
      G5=C3*E5+C5                                                        PC   73
      G6=C3*E6+C6                                                        PC   74
C***  EQUATION 4                                                         PC   75
      H=T4*(F4+T4*(G4+T4*(E4+T4)))                                       PC   76
      H0=(W4-(T4*(F0+T4*(G0+T4*E0))))/H                                  PC   77
      H5=-(T4*(F5+T4*(G5+T4*(E5+T4*T4))))/H                              PC   78
      H6=(W4-(T4*(F6+T4*(G6+T4*E6))))/H                                  PC   79
C***  UPDATE EQUATION 4                                                  PC   80
      I0=F4*H0+F0                                                        PC   81
      I5=F4*H5+F5                                                        PC   82
      I6=F4*H6+F6                                                        PC   83
      J0=G4*H0+G0                                                        PC   84
      J5=G4*H5+G5                                                        PC   85
      J6=G4*H6+G6                                                        PC   86
      K0=E4*H0+E0                                                        PC   87
      K5=E4*H5+E5                                                        PC   88
      K6=E4*H6+E6                                                        PC   89
C***  EQUATION 5                                                         PC   90
      L=T5*(I5+T5*(J5+T5*(K5+T5*(H5+T5))))                               PC   91
      L0=(V5-(T5*(I0+T5*(J0+T5*(K0+T5*H0)))))/L                          PC   92
      L6=(H5-(T5*(I6+T5*(J6+T5*(K6+T5*H6)))))/L                          PC   93
C***  UPDATE EQUATION 5                                                  PC   94
      M0=I5*L0+I0                                                        PC   95
      M6=I5*L6+I6                                                        PC   96
      N0=J5*L0+J0                                                        PC   97
      N6=J5*L6+J6                                                        PC   98
      Q0=K5*L0+K0                                                        PC   99
      Q6=K5*L6+K6                                                        PC  100
      R0=H5*L0+H0                                                        PC  101
      R6=H5*L6+H6                                                        PC  102
      N=X6-X0                                                            PC  103
      P=(T6*(H6+T6*(H6+T6*(Q6+T6*(R6+T6*L6))))-W6)                       PC  104
      IF (DABS(P).LT.1.0D-33) P=1.0D-33                                  PC  105
      XNM=-(T6*(N0+T6*(N0+T6*(Q0+T6*(R0+T6*L0)))))-V6)                   PC  106
      IF (DABS(XNM).LT.1.0D-33) XNM=1.0-33                               PC  107
C***  CHECK EXPONENTS TO PREVENT UNDERFLOWS AND OVERFLOWS                PC  108
      TEXP=DLOG(DABS(XNM))-DLOG(DABS(P))                                 PC  109
      IF (TEXP.LT.-77.0D0) GO TO 5                                       PC  110
      IF (TEXP.LE.74.0D0) GO TO 1                                        PC  111
      IX1=-1.0D0                                                         PC  112
      IX2=-1.0D0                                                         PC  113
      IF (DABS(XNM).EQ.XNM) IX1=1.0D0                                    PC  114
      IF (DABS(P).EQ.P) IX2=1.0D0                                        PC  115
      IXS=IX1*IX2                                                        PC  116
      P=-1.0D+74                                                         PC  117
      IF (IXS.GT.0.0D0) P=1.0D+74                                        PC  118
      IF (P.LT.0.0D0) GO TO 5                                            PC  119
      GO TO 2                                                            PC  120
C***  CALCULATE COEFFICIENTS                                             PC  121
    1 P=XNM/P                                                            PC  122
C***  TEST FOR MACHINE LIMIT                                             PC  123
    2 IF ((P*H).LT.22.0D0) GO TO 3                                       PC  124
      P=22.0D0/H                                                         PC  125
    3 IF (P.LT.1D1) GO TO 5                                              PC  126
      A0=DY0                                                             PC  127
      A1=H0*P*H6                                                         PC  128
      A2=N0*P*N6                                                         PC  129
      A3=Q0*P*Q6                                                         PC  130
      A4=R0*P*R6                                                         PC  131
      A5=L0*P*L6                                                         PC  132
```

```
    4 RETURN                                                          PC  133
    5 P=0D0                                                           PC  134
      GO TO 4                                                         PC  135
      END                                                             PC  136


      FUNCTION PHIDER(M,XX,K,ICF1,ICF2)                               PD    1
C                                                                     PD    2
C***  FUNCTION PHIDER IS CAPABLE OF COMPUTING THE DERIVATIVE AND/OR   PD    3
C***  ANTIDERIVATIVE OF PHI (AS DESCRIBED IN SUBROUTINE PHICEF).  IT  PD    4
C***  SHOULD BE NOTED THAT                                            PD    5
C***  M  DEFINES THE NUMBER OF TERMS OF PHI TO USE OR THE NUMBER OF   PD    6
C***  TERMS THAT ARE AVAILABLE TO USE                                 PD    7
C***  XX DEFINES THE VALUE OF X AT WHICH TO CALCULATE THE DERIVATIVE OR PD    8
C***  ANTIDERIVATIVE                                                  PD    9
C***  K SPECIFIES THE DERIVATIVE TO TO CALCULATE: K MAY BE ANY INTEGER PD   10
C***  SUCH THAT POSITIVE (DERIVATIVES), ZERO (PHI), NEGATIVE (ANTIDERI- PD   11
C***  VATIVES)).                                                      PD   12
C                                                                     PD   13
      IMPLICIT REAL*8(A-H,O-Z)                                        PD   14
      DIMENSION DFACT(13)                                             PD   15
      COMMON /AWRK/A(7),C(7,8)                                        PD   16
      COMMON /LABE/JWRITE,IERR                                        PD   17
      COMMON /PCB/F(7),X(7),Y(7)                                      PD   18
      DATA DFACT/1.0D0,1.0D0,2.0D0,6.0D0,2.4D1,1.2D2,7.2D2,5.04D3,4.032D PD   19
     1D4,3.6288D5,3.6288D6,3.99168D7,4.790016D8/                      PD   20
C                                                                     PD   21
      IF (M.LT.1.OR.M.GT.7) GO TO 9                                   PD   22
C***  TRANSLATE                                                       PD   23
      SVE=X(1)                                                        PD   24
      DO 1 I=1,M                                                      PD   25
    1 X(I)=X(I)-SVE                                                   PD   26
      XX=XX-SVE                                                       PD   27
    2 IF (ICF1.GT.ICF2) GO TO 3                                       PD   28
      CALL PHICEF(ICF1)                                               PD   29
      ICF1=ICF1+1                                                     PD   30
      GO TO 2                                                         PD   31
    3 PHIDER=0D0                                                      PD   32
      I=K+1                                                           PD   33
      IF (I.LT.1) I=1                                                 PD   34
    4 IF (I.GT.M) GO TO 6                                             PD   35
      S=1D0                                                           PD   36
      CPT=0D0                                                         PD   37
      J2=I-K                                                          PD   38
      IF (J2.GT.I)J2=I                                                PD   39
      DO 5 J=1,J2                                                     PD   40
      CPT=CPT+S*DFACT(I-J+1)/DFACT(I-J-K+1)*C(I,J)*(XX**(I-J-K))      PD   41
    5 S=-S                                                            PD   42
      PHIDER=PHIDER+A(I)*CPT                                          PD   43
      I=I+1                                                           PD   44
      GO TO 4                                                         PD   45
C***  RESET                                                           PD   46
    6 XX=XX+SVE                                                       PD   47
      DO 7 I=1,M                                                      PD   48
    7 X(I)=X(I)+SVE                                                   PD   49
    8 RETURN                                                          PD   50
    9 IERR=1                                                          PD   51
      WRITE (JWRITE,10) M                                             PD   52
   10 FORMAT (1H ,'*** PHIDER ERROR: M=',I11,' BUT 1<=M<=7 REQUIRED') PD   53
      GO TO 8                                                         PD   54
      END                                                             PD   55


      SUBROUTINE PHETH                                                PH    1
C                                                                     PH    2
C***  SUBROUTINE PHETH PRODUCES A CORRECTED VALUE OF Y(N+1)           PH    3
C                                                                     PH    4
      IMPLICIT REAL*8(A-Z)                                            PH    5
      COMMON /CBCOEF/P,A0,A1,A2,A3,A4,A5,H                            PH    6
      COMMON /PCB/DY0,DY1,DY2,DY3,DY4,DY5,DY6,X0,X1,X2,X3,X4,X5,X6,Y0,Y1 PH    7
     1,Y2,Y3,Y4,Y5,Y6                                                 PH    8
C                                                                     PH    9
      PH=P*H                                                          PH   10
C***  COMPUTE THE TREANOR P-VALUES                                    PH   11
      P0=0.0D0                                                        PH   12
      IF ((-PH).LT.174.673D0.AND.(-PH).GT.-180.218D0)P0=DEXP(-PH)     PH   13
      P1=(P0-1D0)/(-PH)                                               PH   14
      P2=(P1-1D0)/(-PH)                                               PH   15
      P3=(P2-(1D0/2D0))/(-PH)                                         PH   16
      P4=(P3-(1D0/6D0))/(-PH)                                         PH   17
      P5=(P4-(1D0/24D0))/(-PH)                                        PH   18
      P6=(P5-(1D0/120D0))/(-PH)                                       PH   19
C***  COMPUTE A CORRECTED VALUE OF Y(N+1)                             PH   20
      Y6=YC+H*(A0*P1+H*(A1*P2+H*(2D0*A2*P3+H*(6D0*A3*P4+H*(24D0*A4*P5+H* PH   21
     1120D0*A5*P6))))                                                 PH   22
      RETURN                                                          PH   23
      END                                                             PH   24


      SUBROUTINE LOC(I,J,IR,M,N,MS)                                   LC    1
C                                                                     LC    2
C***  SUBROUTINE LOC COMPUTES A VECTOR-SUBSCRIPT FOR AN ELEMENT IN A  LC    3
C***  MATRIX OF SPECIFIED STORAGE MODE                                LC    4
C                                                                     LC    5
      IX=I                                                            LC    6
      L=J                                                             LC    7
      IF (MS-1)  1,2,5                                                LC    8
    1 IR=M*(I-1)+IX                                                   LC    9
      GO TO 7                                                         LC   10
    2 IF (IX-L)  3,4,4                                                LC   11
    3 IR=IX+(L*L-L)/2                                                 LC   12
      GO TO 7                                                         LC   13
    4 IR=L*(IX+IX-IX)/2                                               LC   14
      GO TO 7                                                         LC   15
    5 IR=0                                                            LC   16
      IF (IX-L)  7,6,7                                                LC   17
    6 IR=IX                                                           LC   18
    7 IR=IR                                                           LC   19
      RETURN                                                          LC   20
      END                                                             LC   21


      SUBROUTINE MATA(A,R,M,N,MS)                                     MT    1
C                                                                     MT    2
C***  SUBROUTINE MATA PREMULTIPLIES A MATRIX BY ITS TRANSPOSE TO FORM MT    3
C***  A SYMMETRIC MATRIX                                              MT    4
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```
C       IMPLICIT REAL*8(A-H,O-Z)
        DIMENSION A(1),R(1)
C
        DO 6 K=1,N
        KK=(K**K-K)/2
        DO 6 J=1,N
        IF (J-K)  1,1,6
1       IR=J+KK
        R(IR)=0.0D0
        DO 6 I=1,N
        IF (MS)  2,4,2
2       CALL IOC(I,J,IA,N,M,MS)
        CALL IOC(1,K,IB,N,M,MS)
        IF (IA)  3,6,3
3       IF (IB)  5,6,5
4       IA=M*(J-1)+I
        IB=M*(K-1)+1
5       R(IR)=R(IR)+A(IA)*A(IB)
6       CONTINUE
        RETURN
        END
```

```
MT     5
MT     6
MT     7
MT     8
MT     9
MT    10
MT    11
MT    12
MT    13
MT    14
MT    15
MT    16
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MT    18
MT    19
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Flowchart — FDRI

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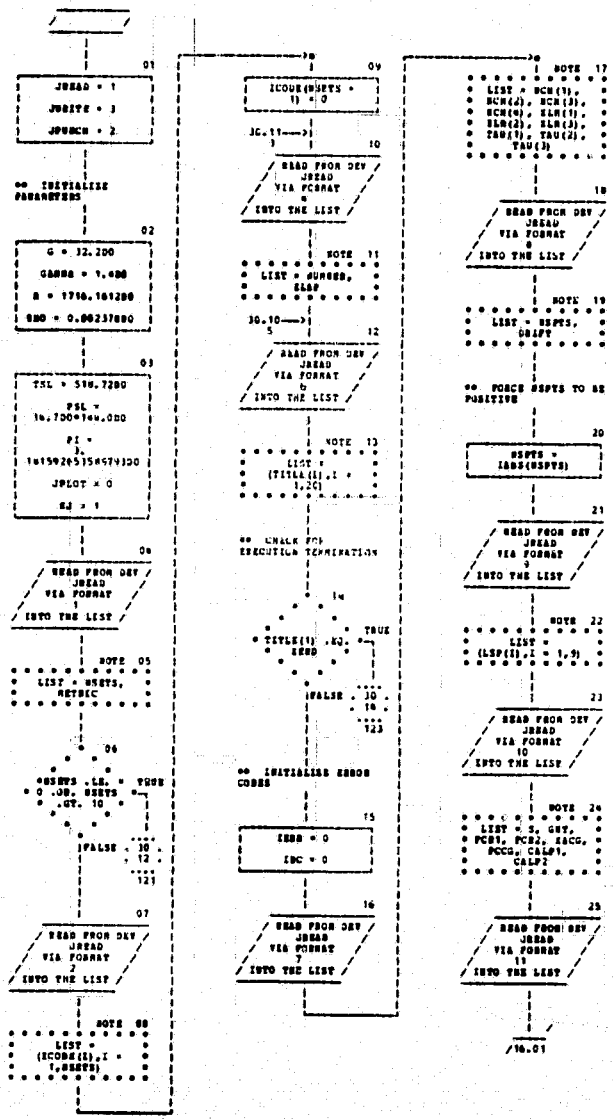


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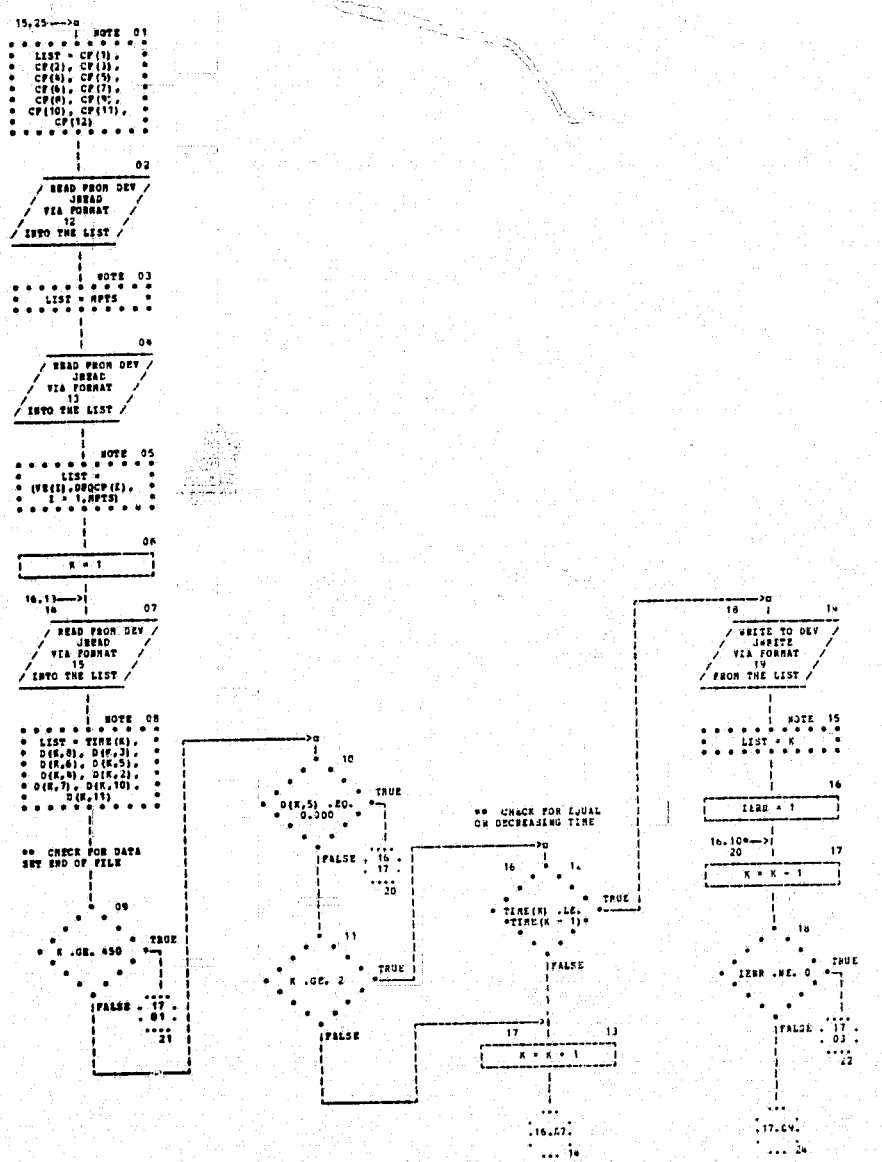


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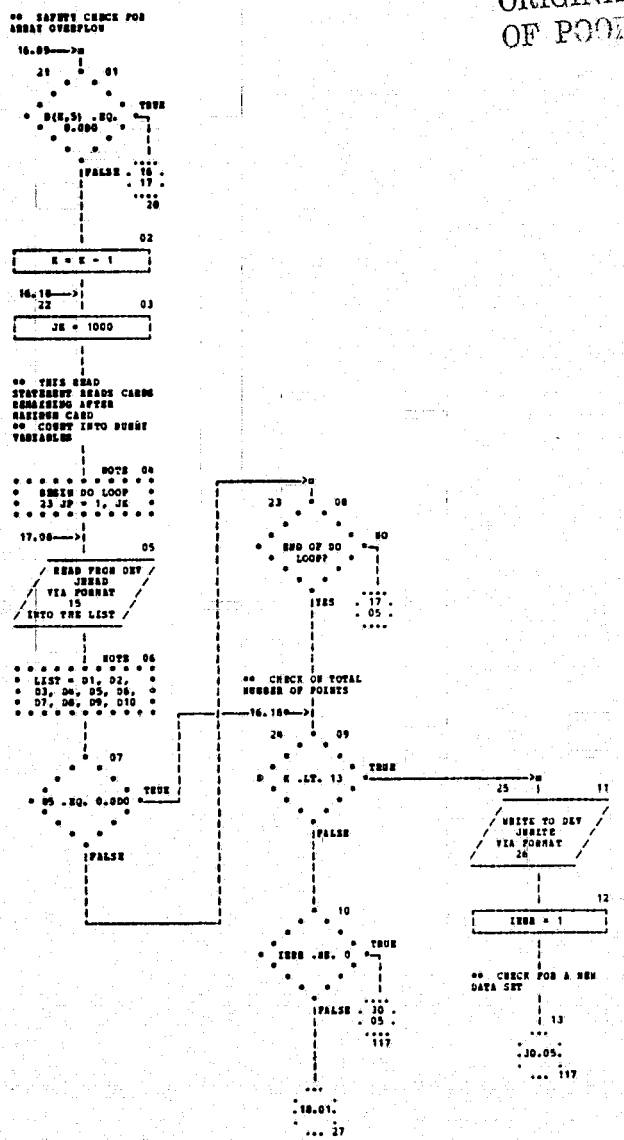
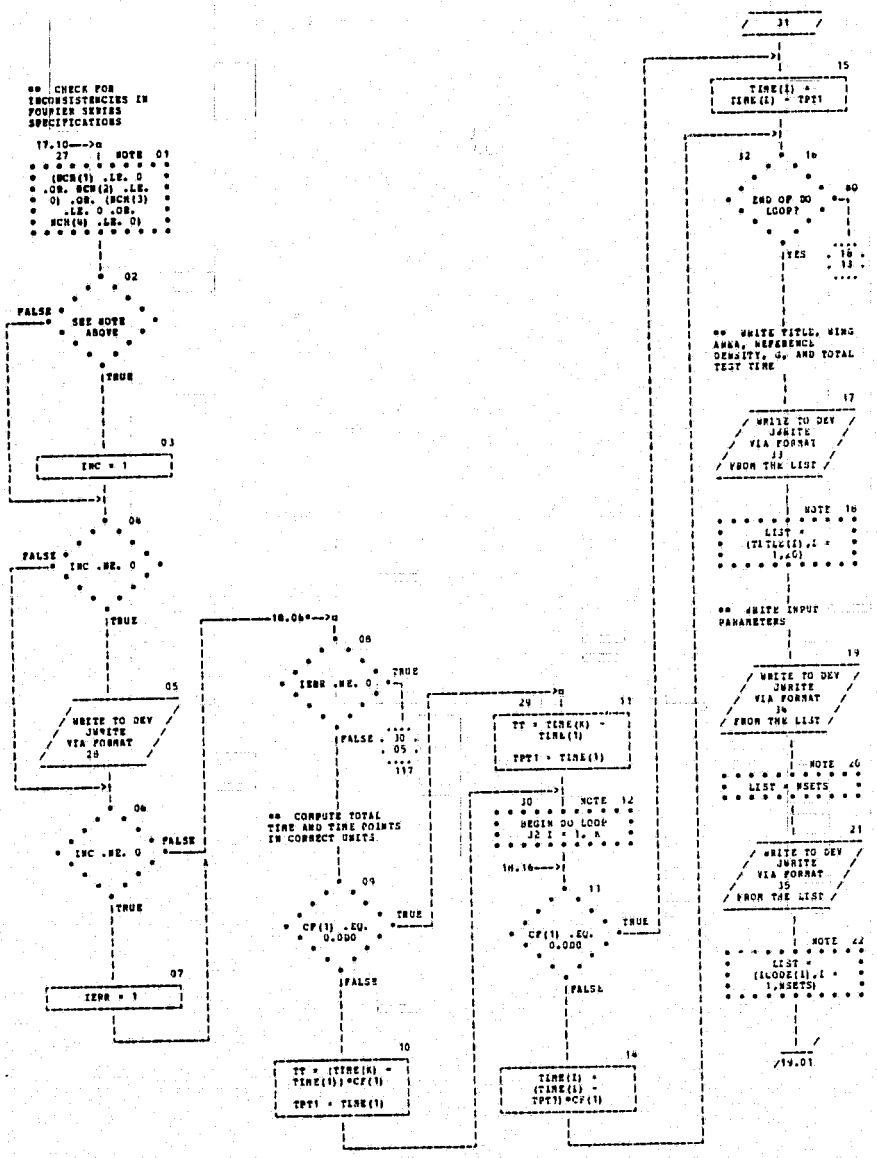


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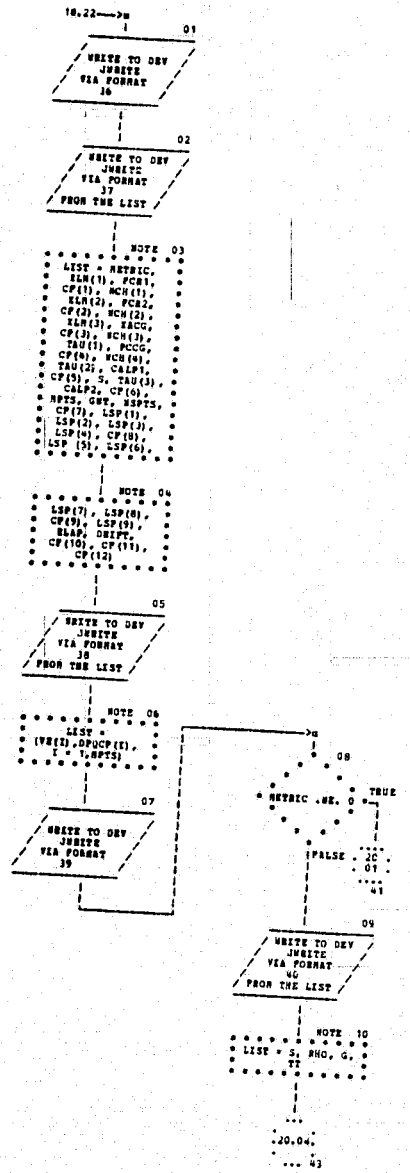
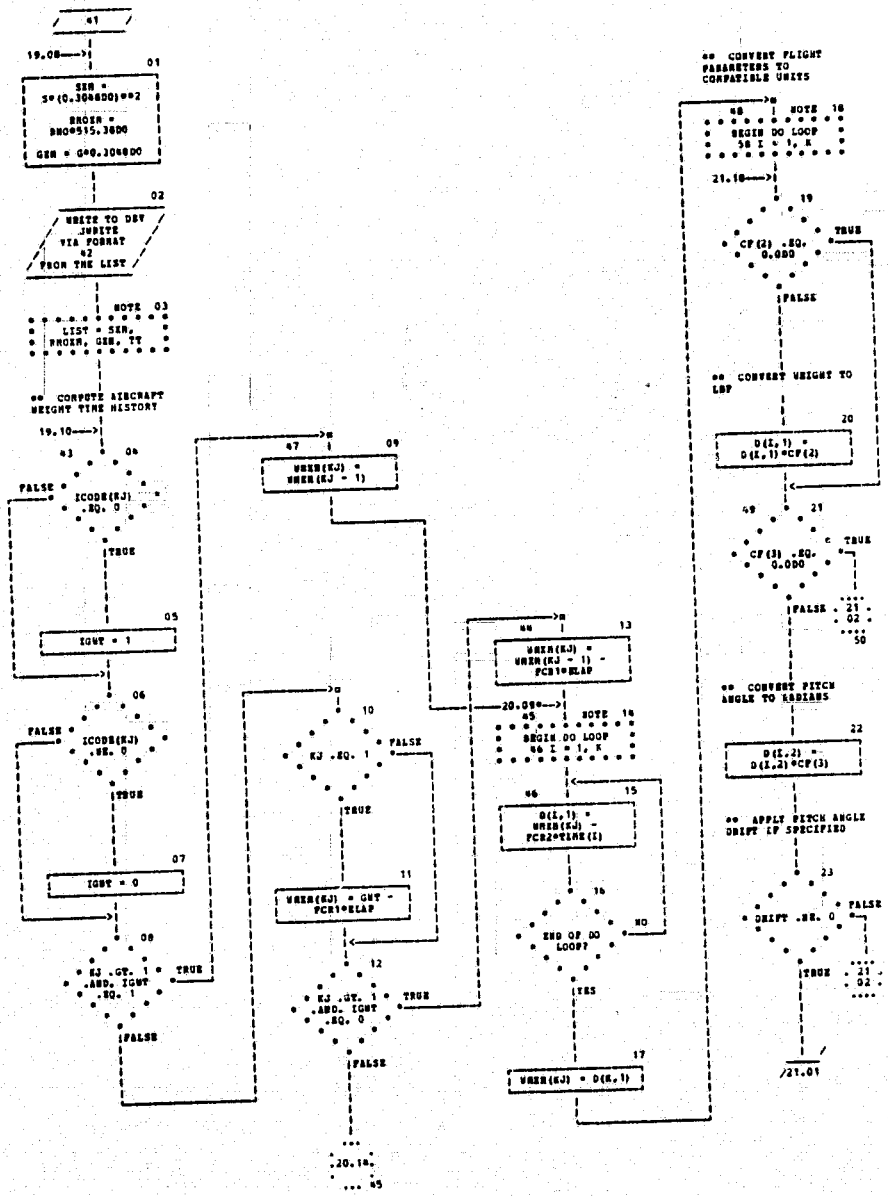


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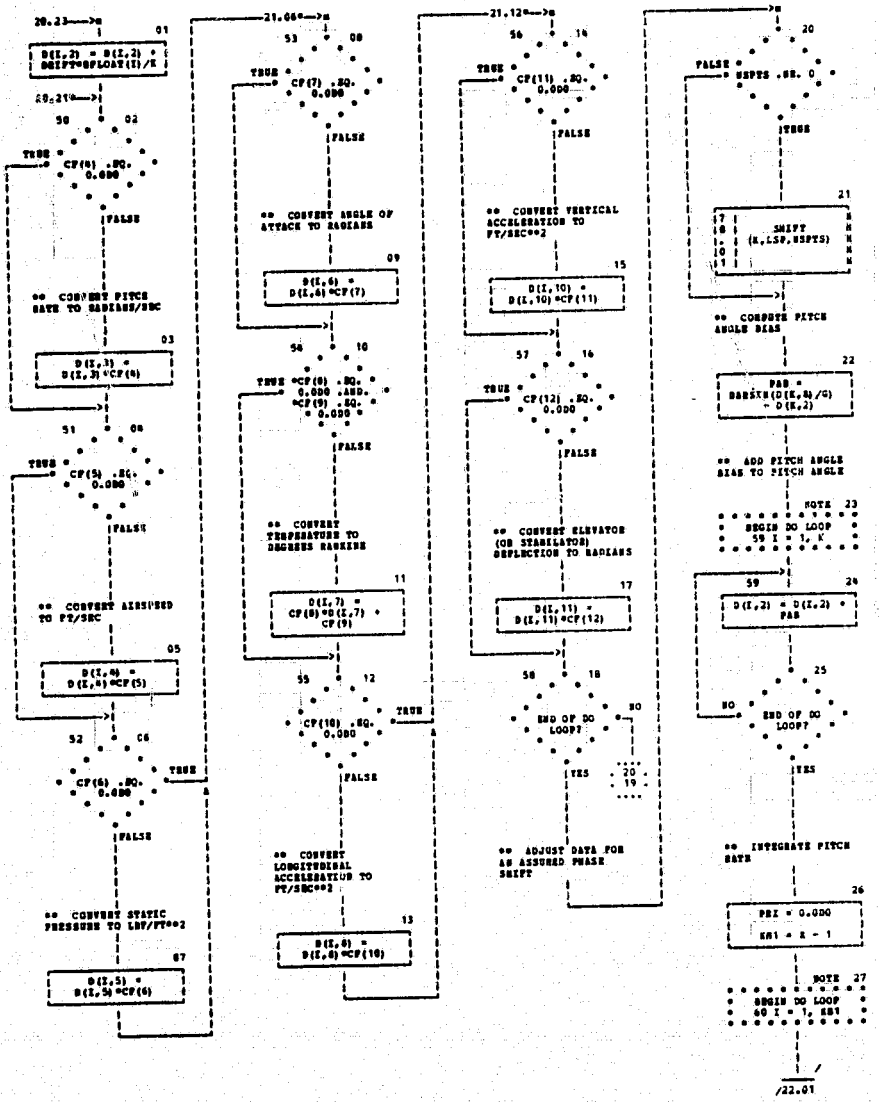
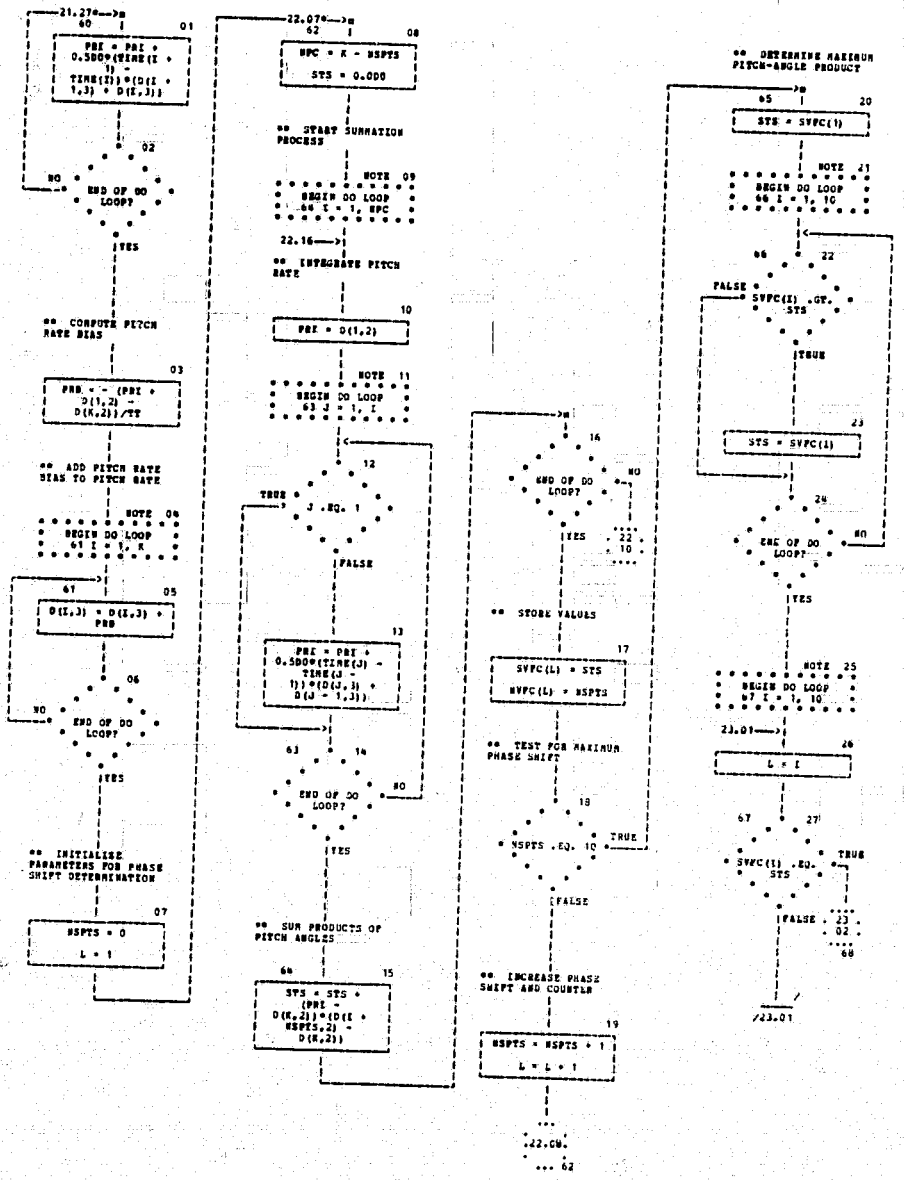


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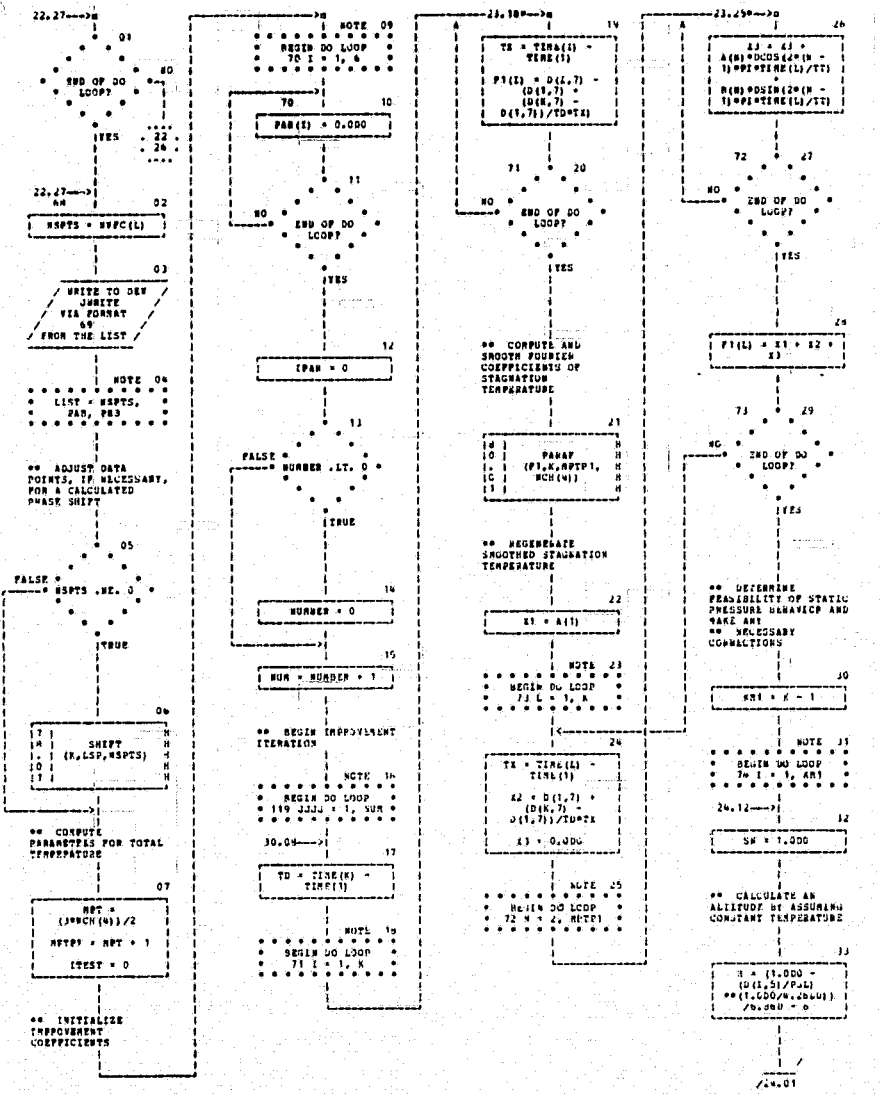
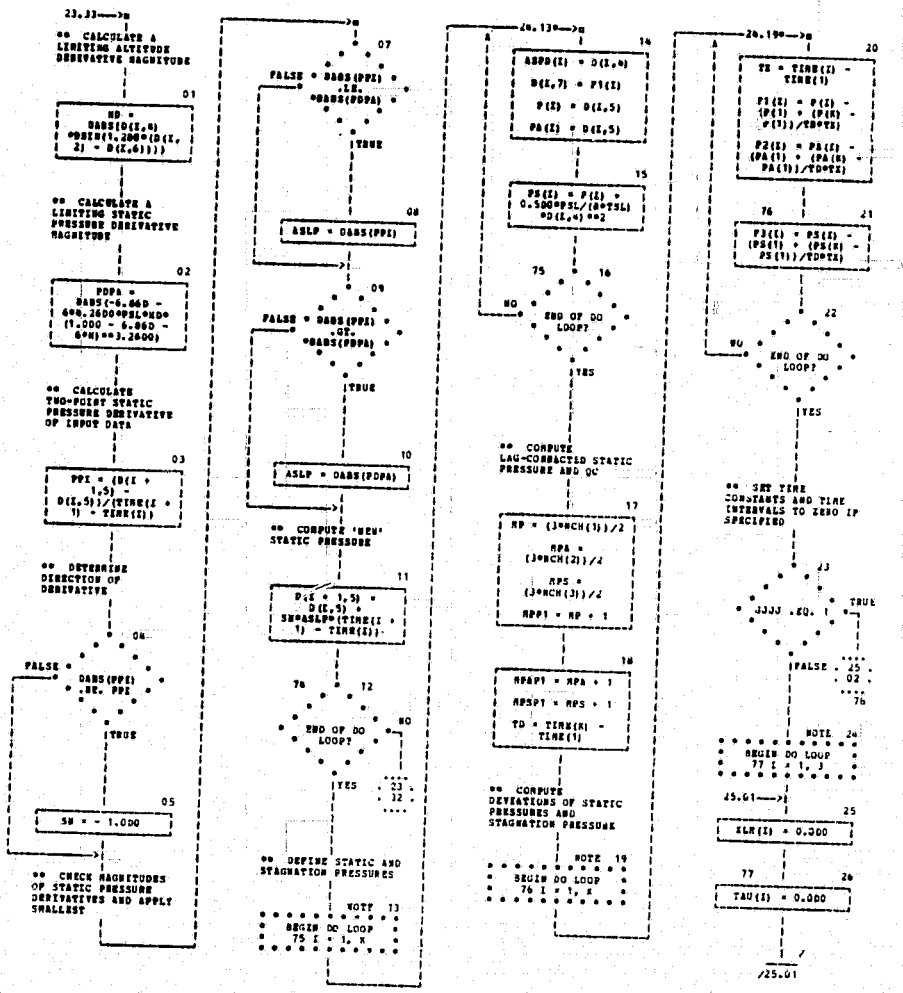


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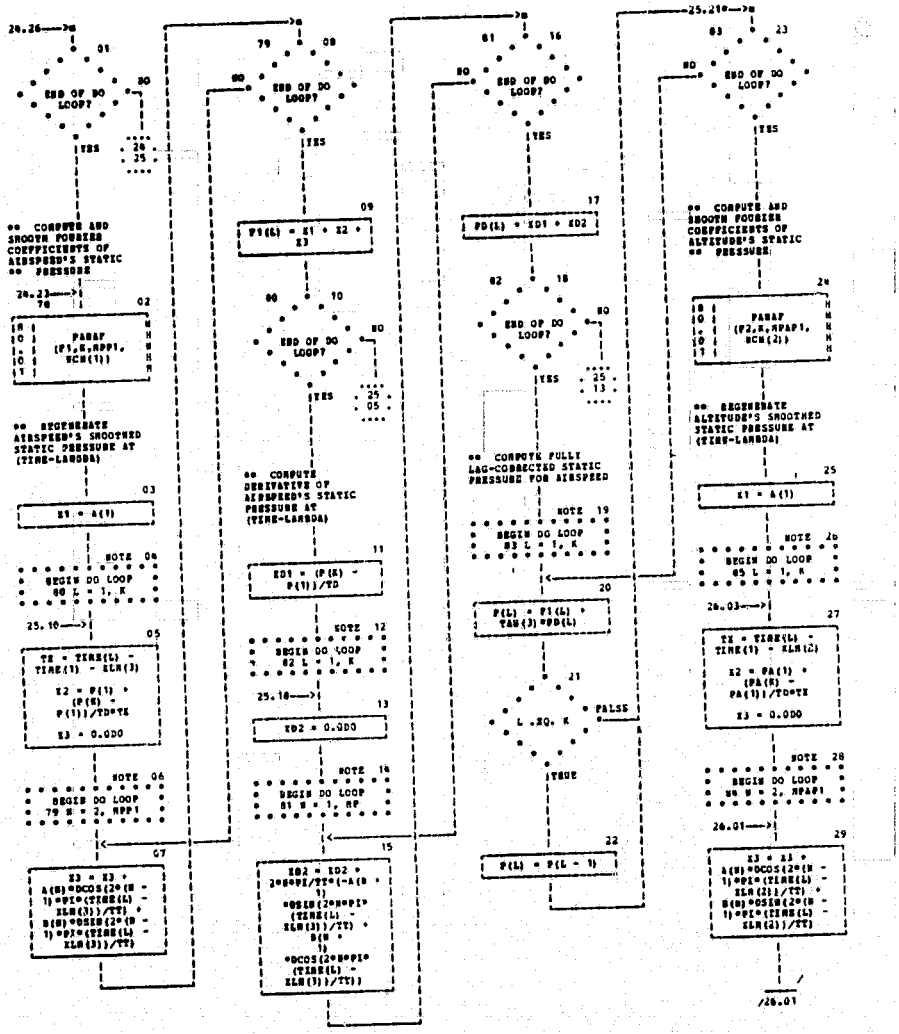
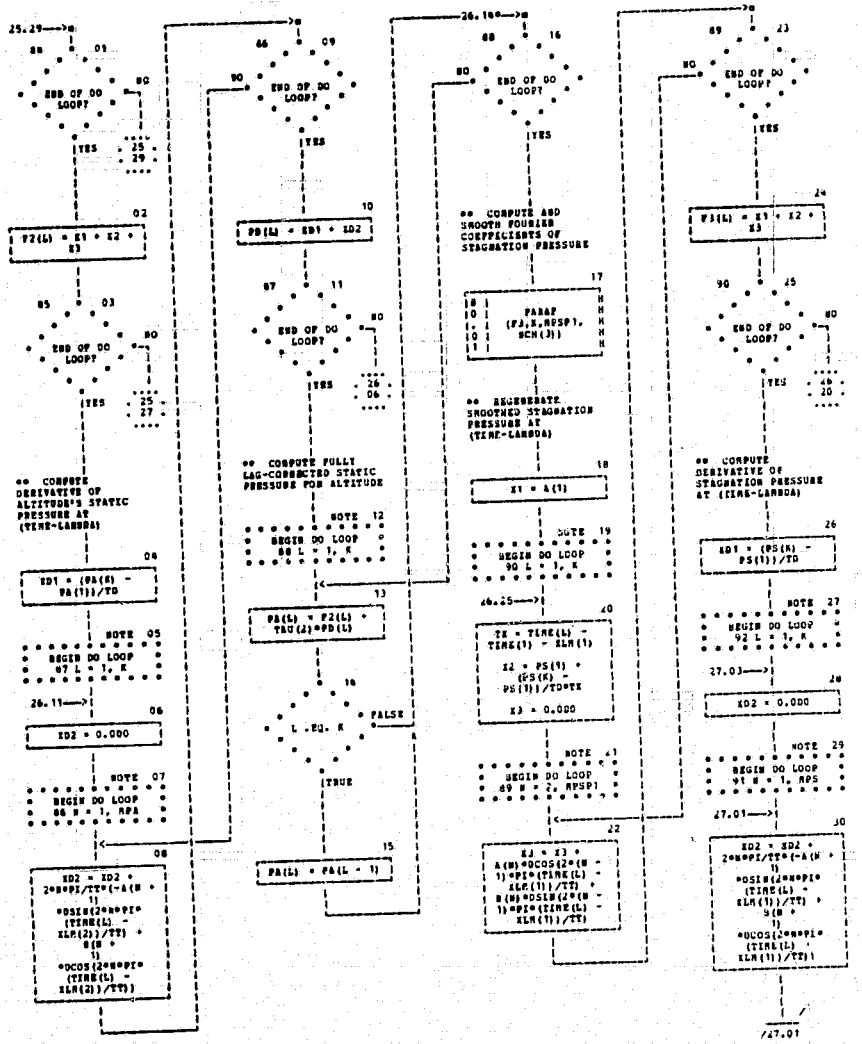


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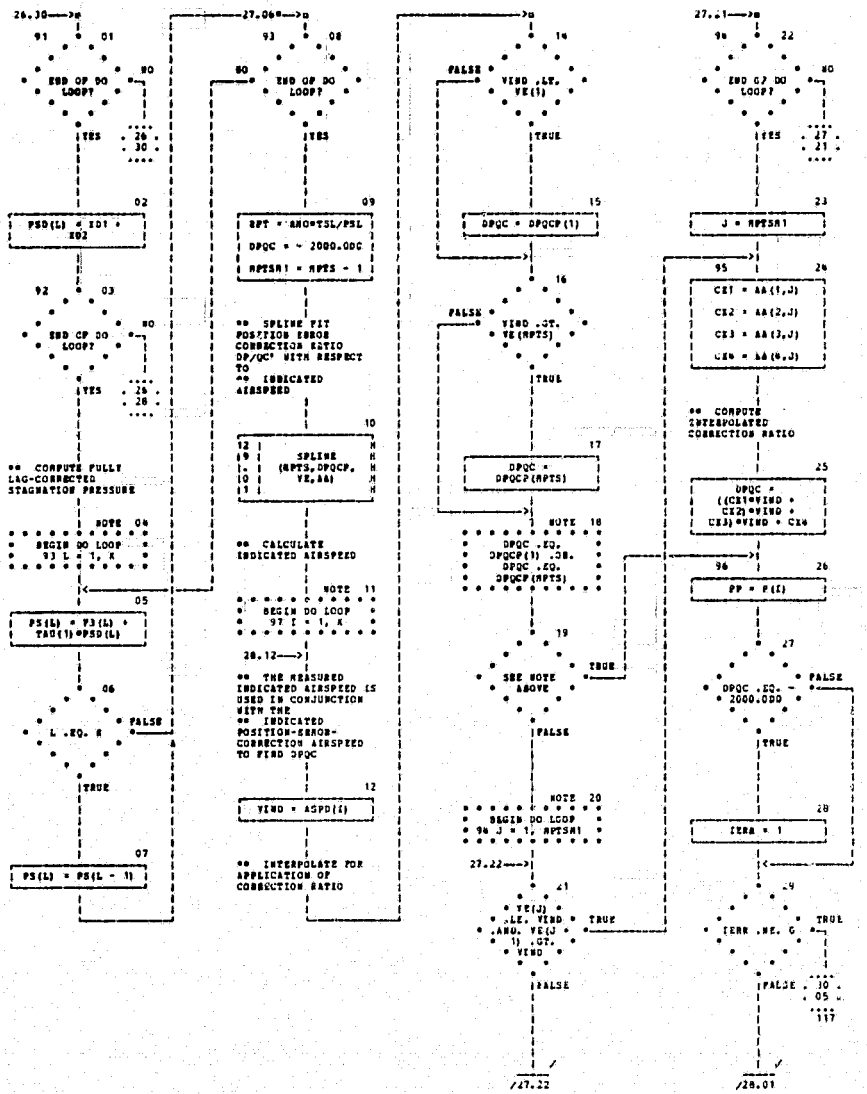
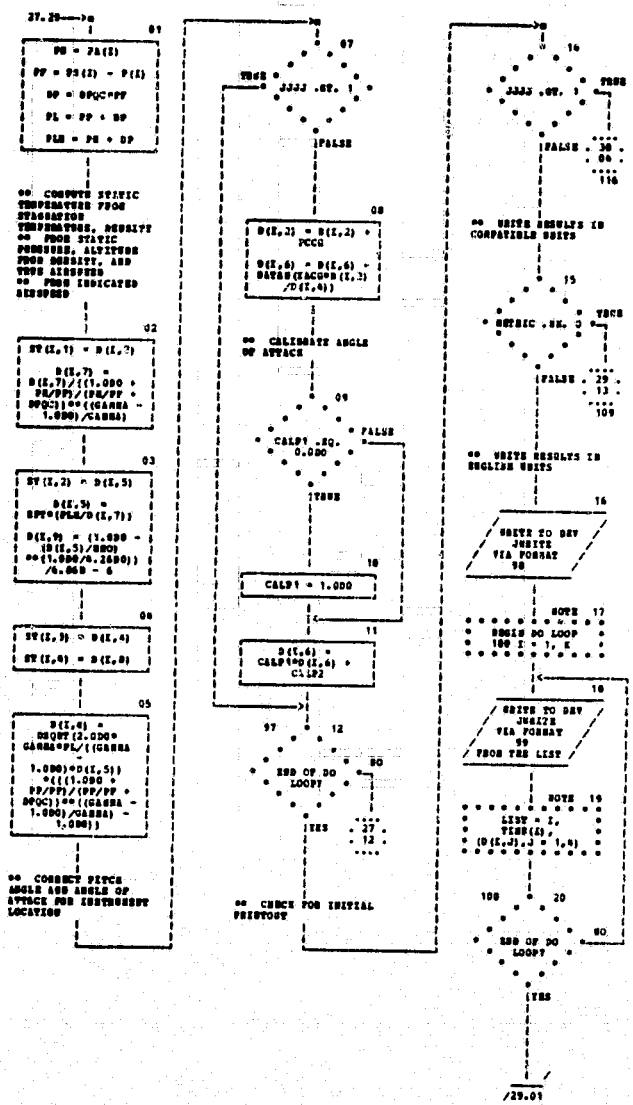


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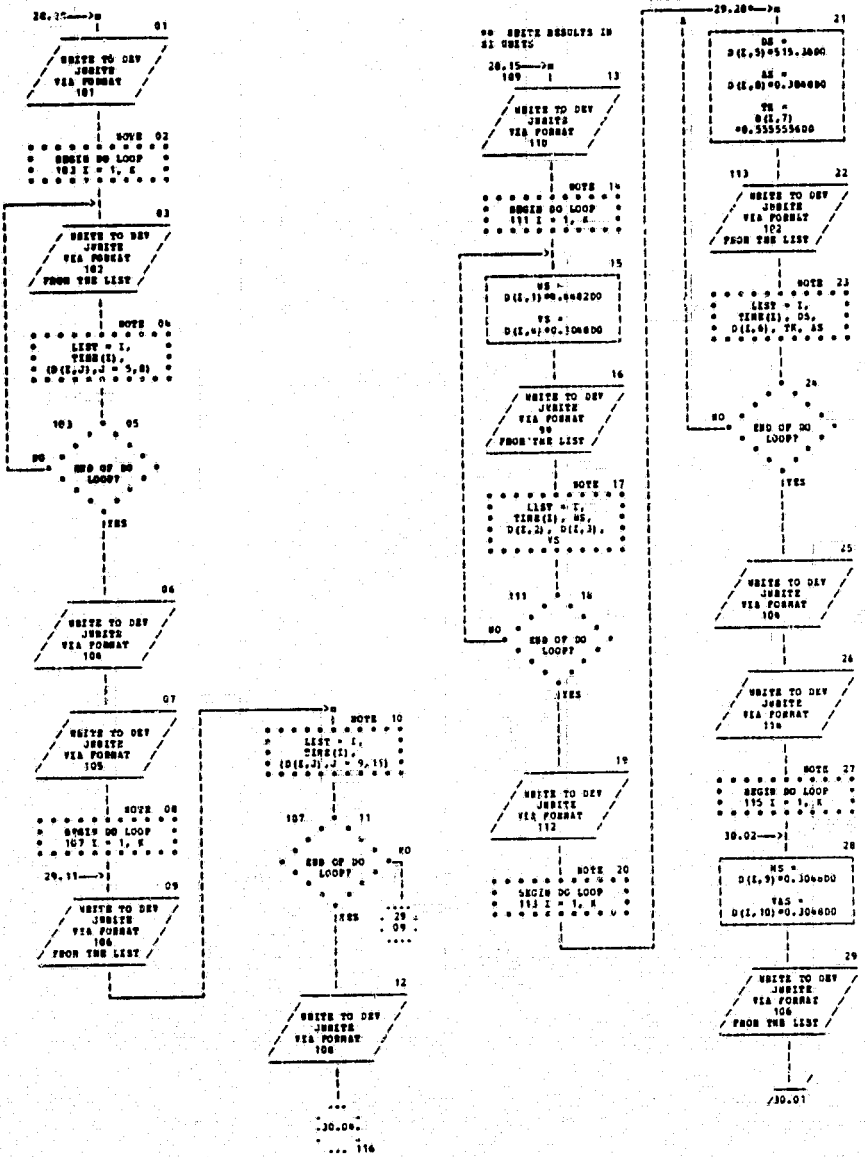
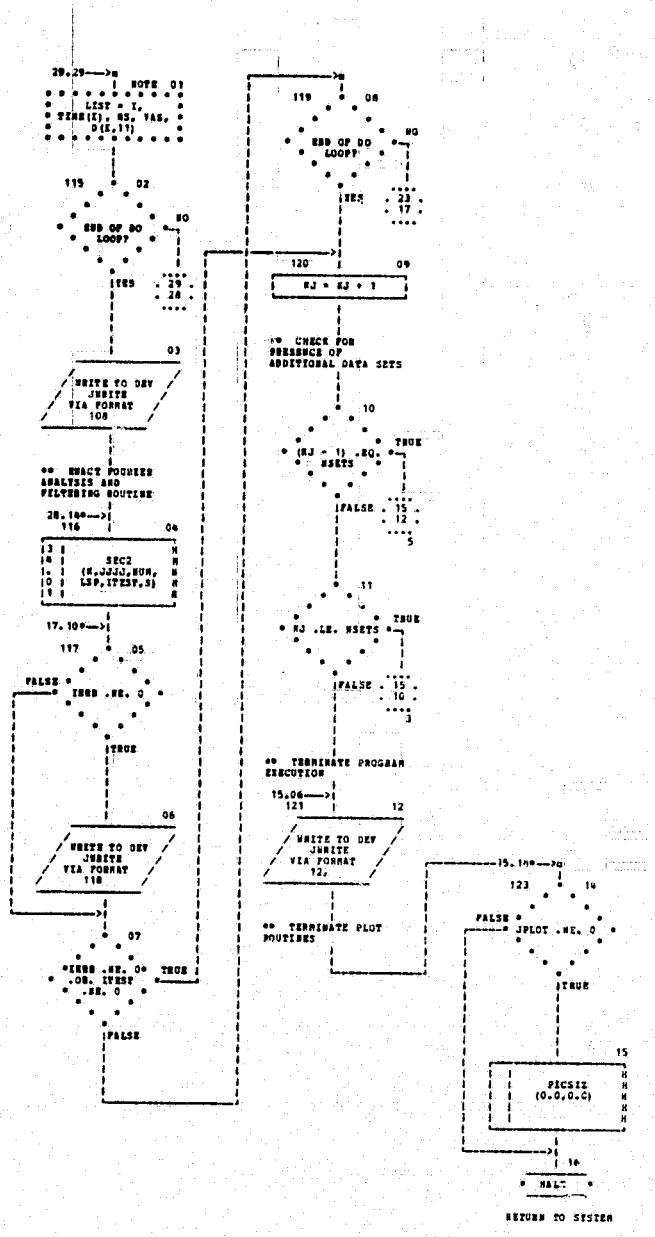


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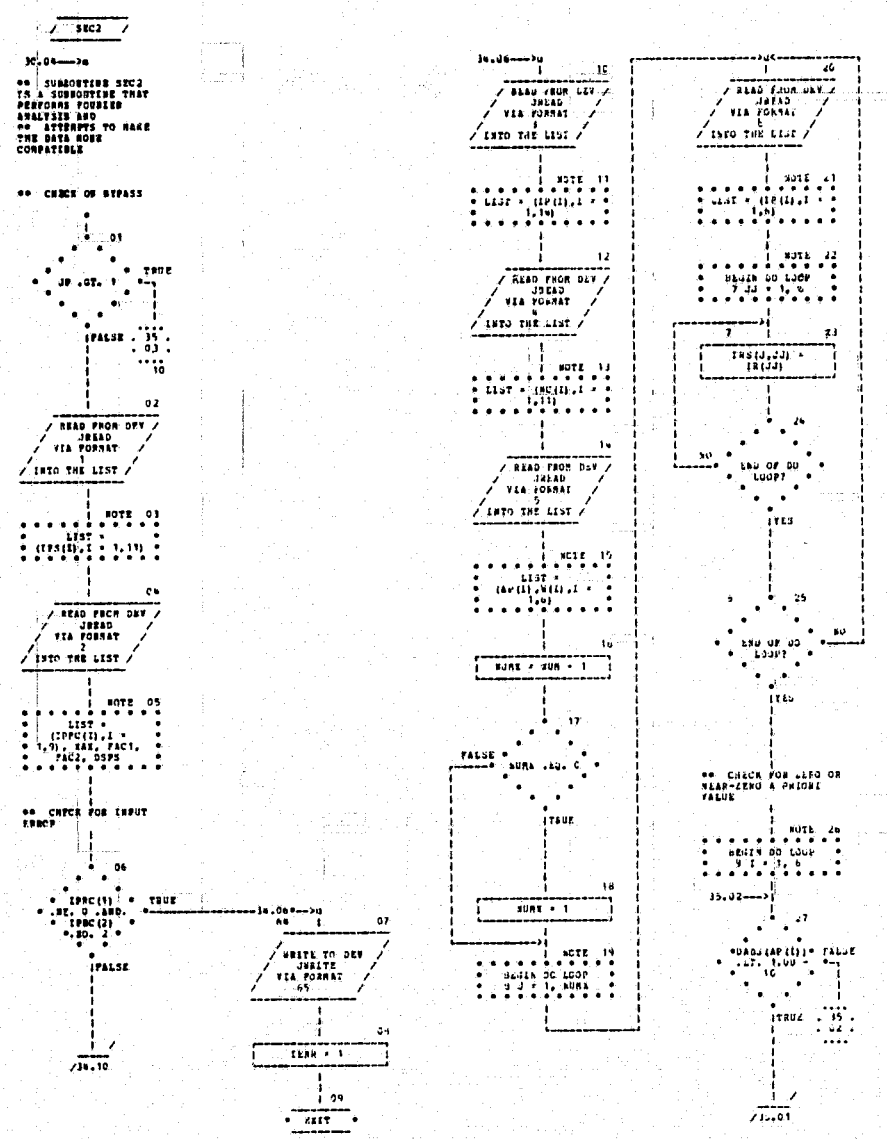
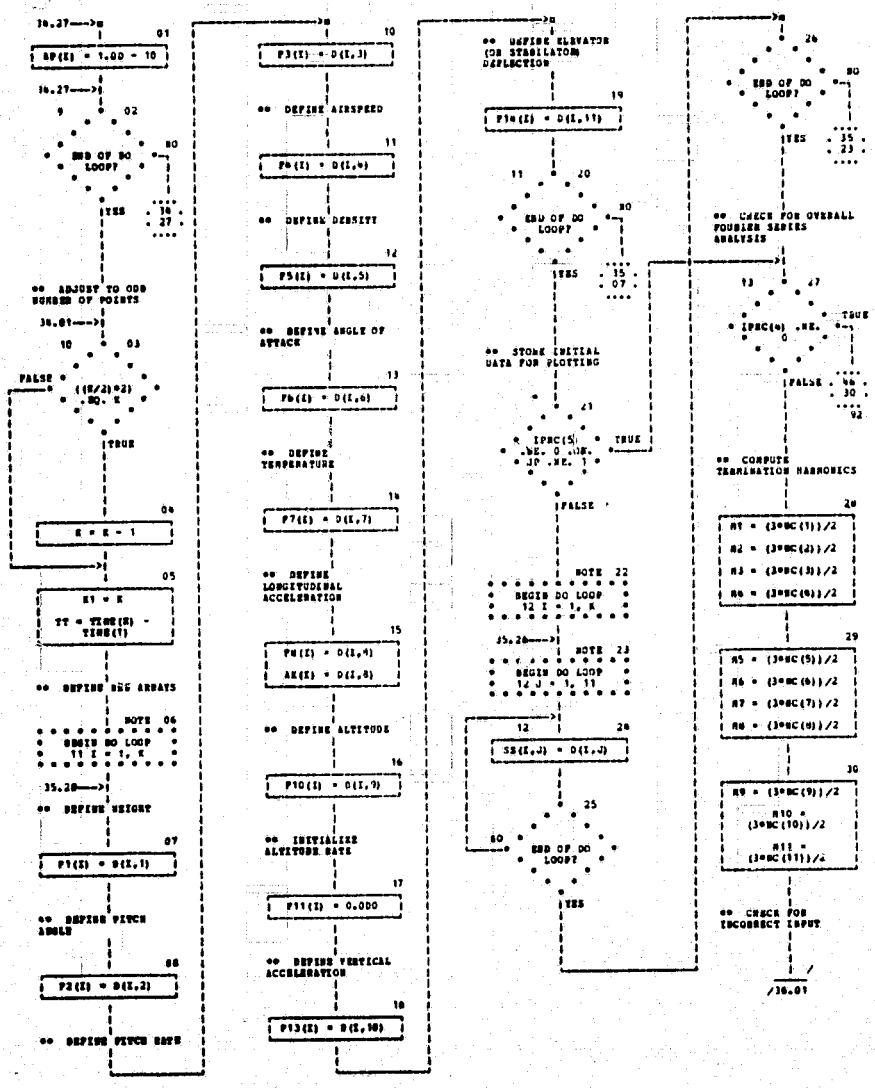


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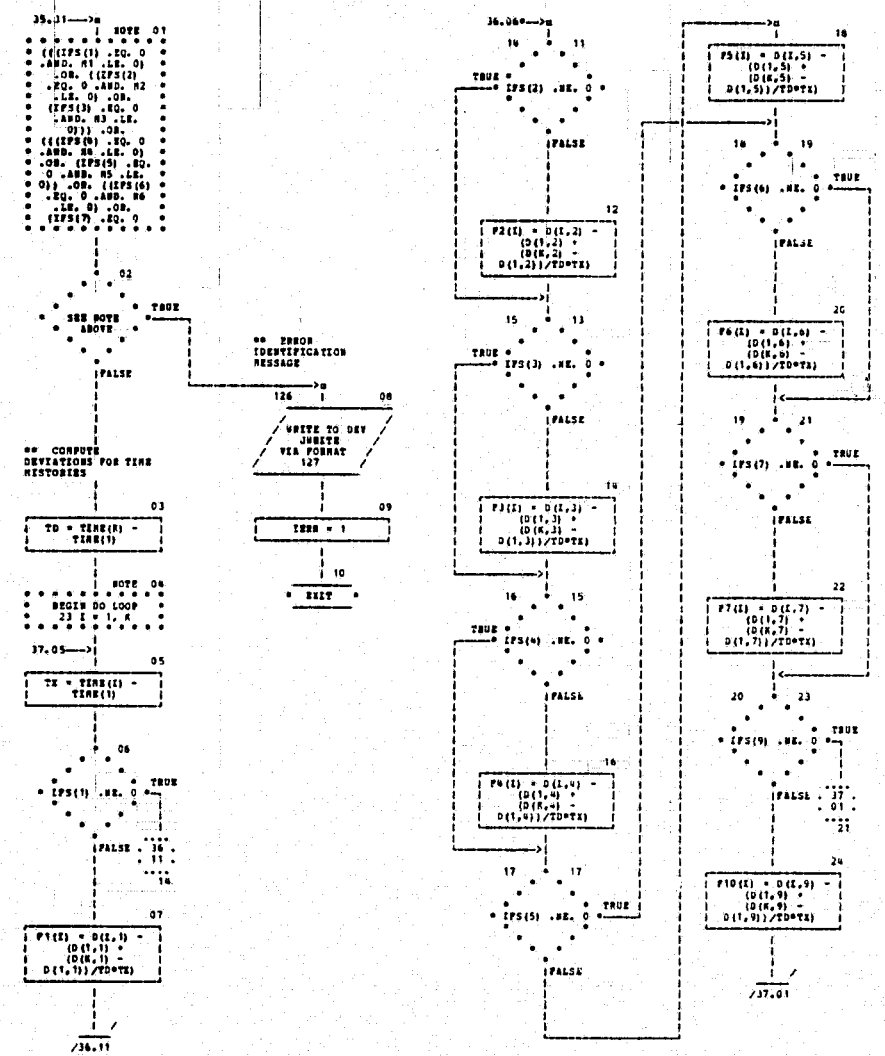
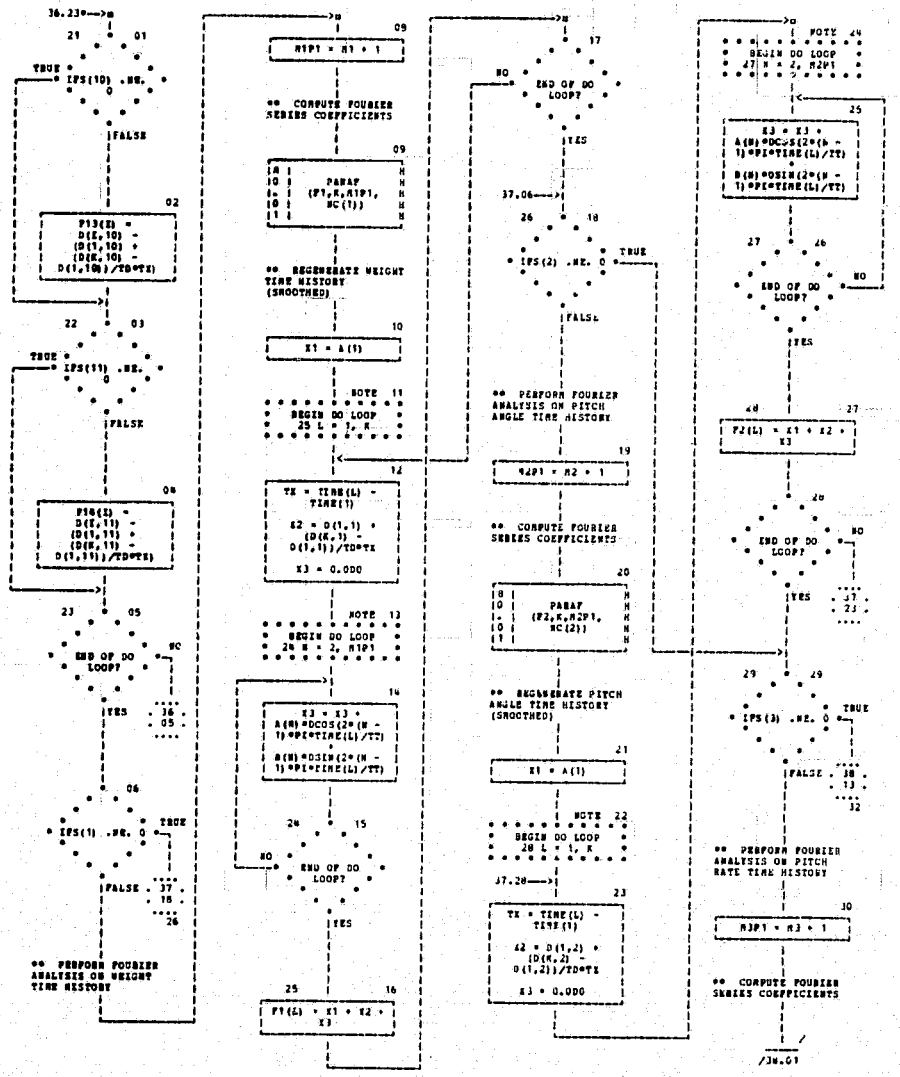


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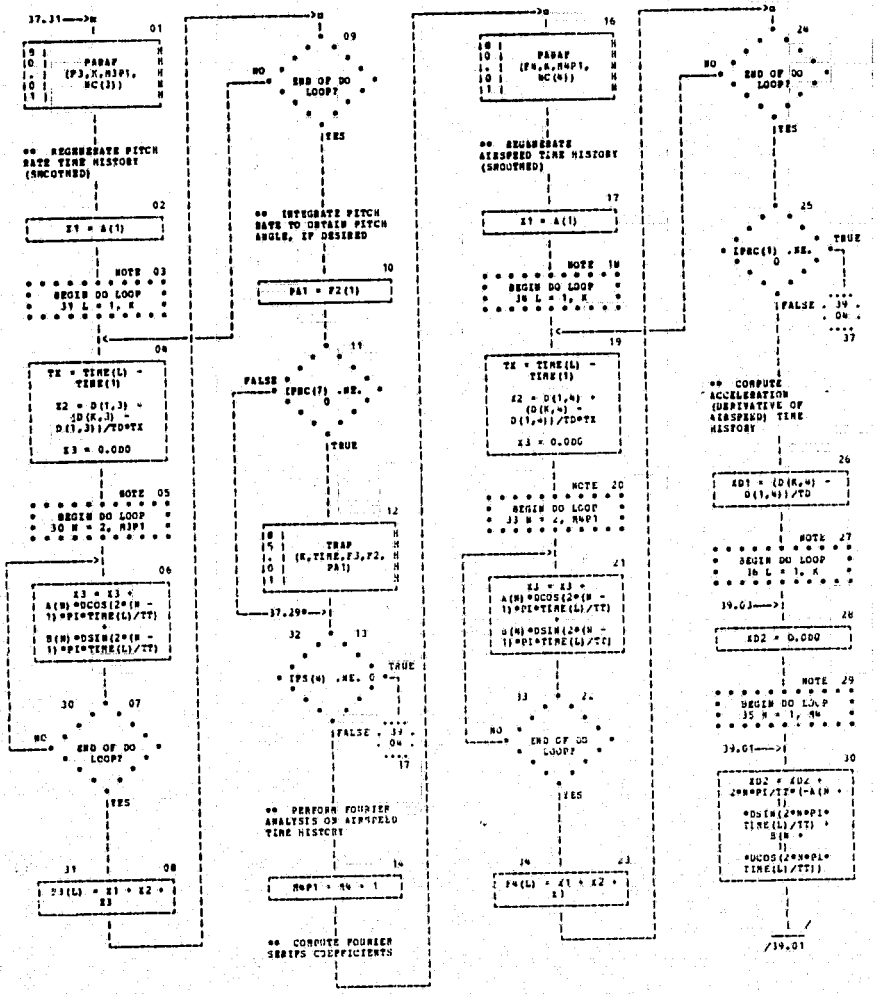
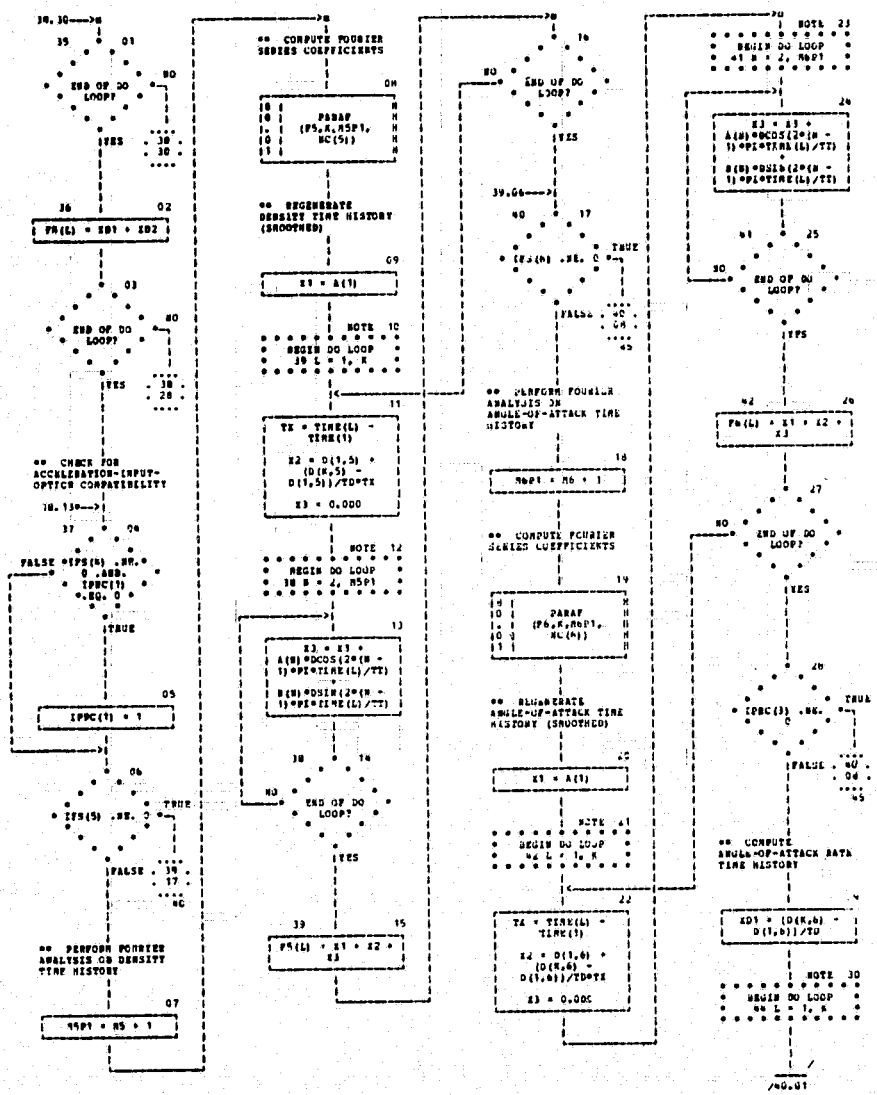


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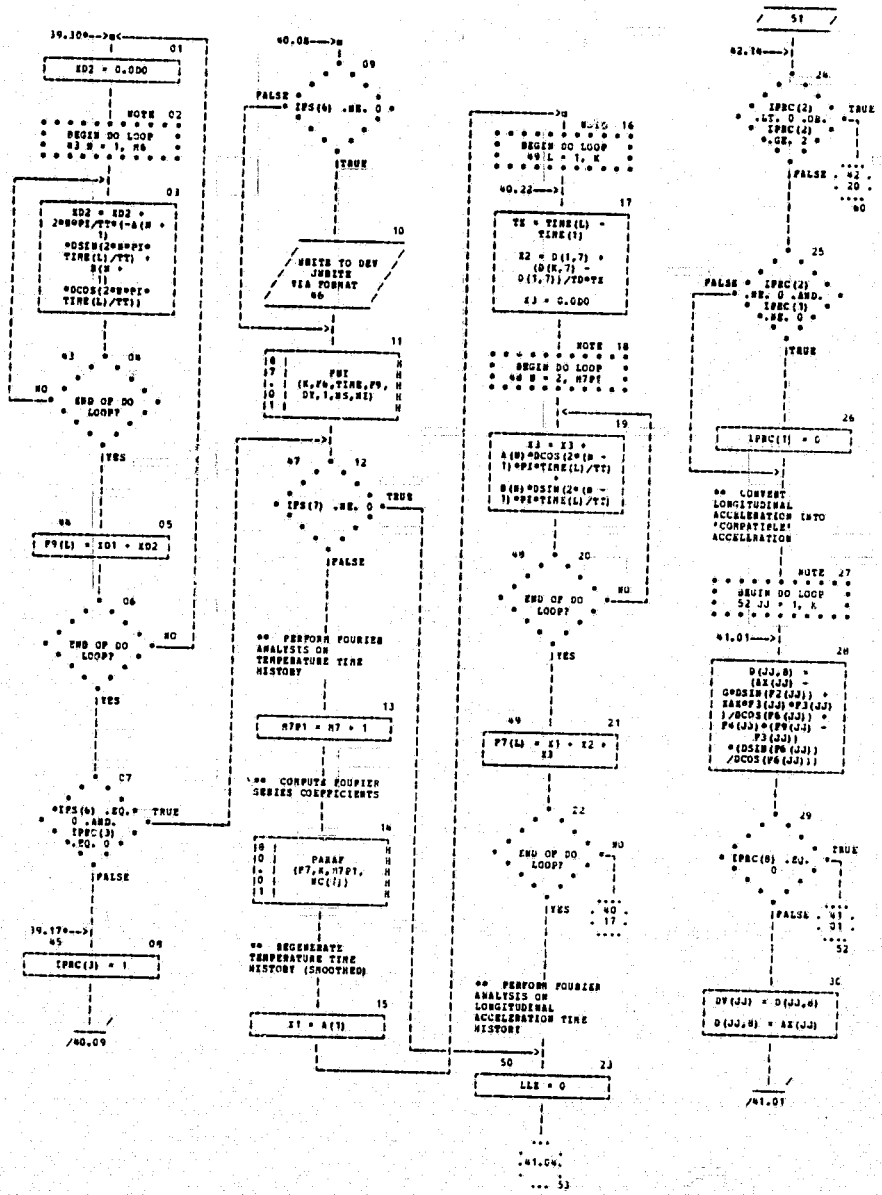
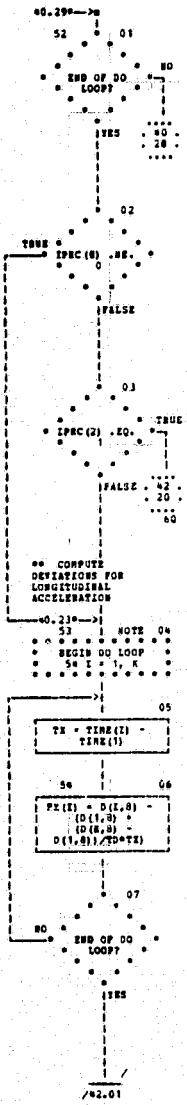


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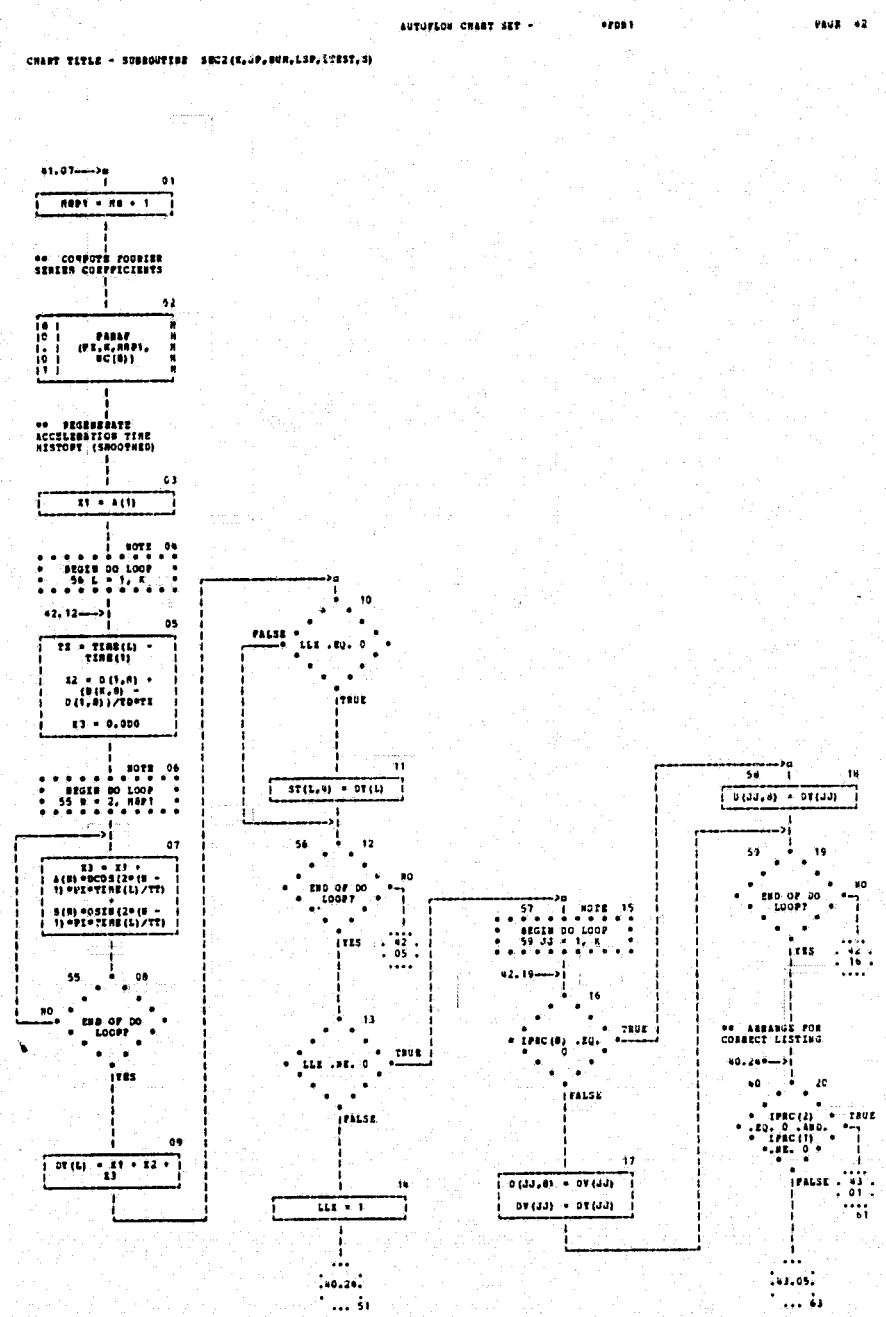
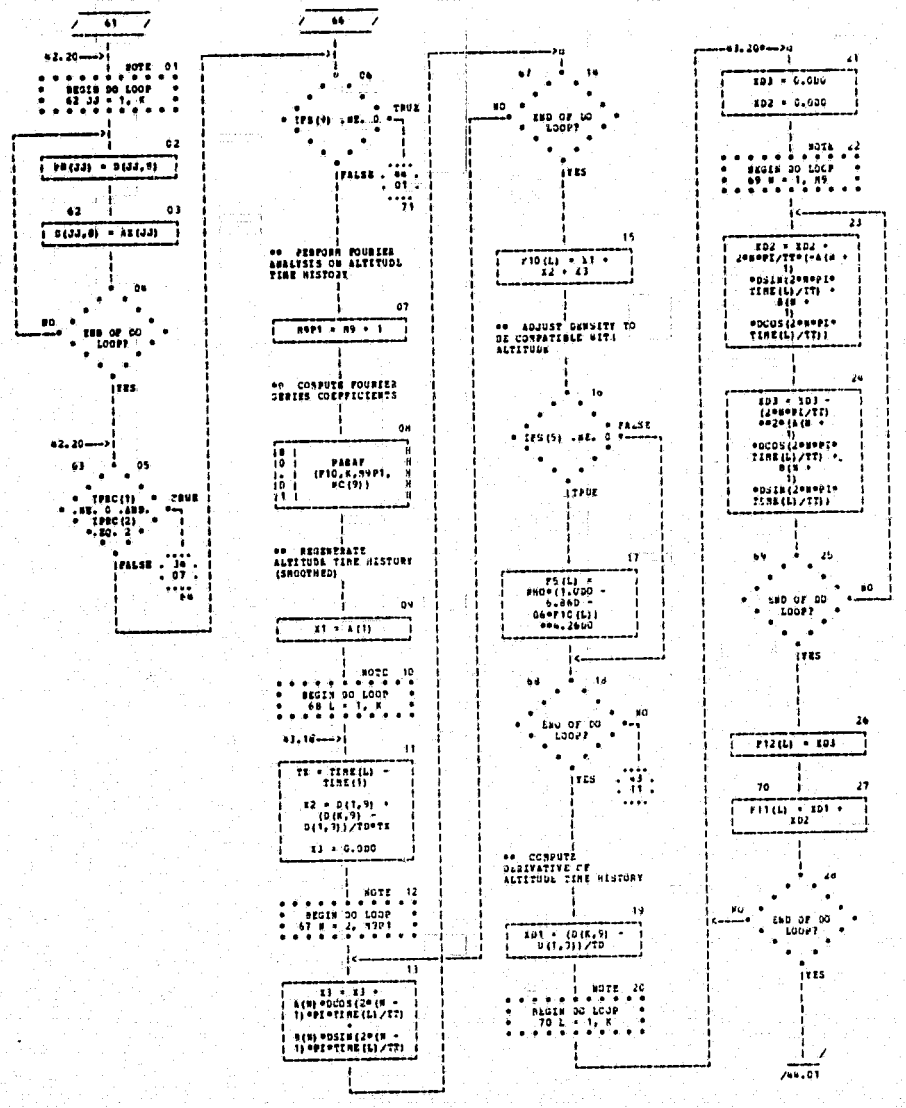


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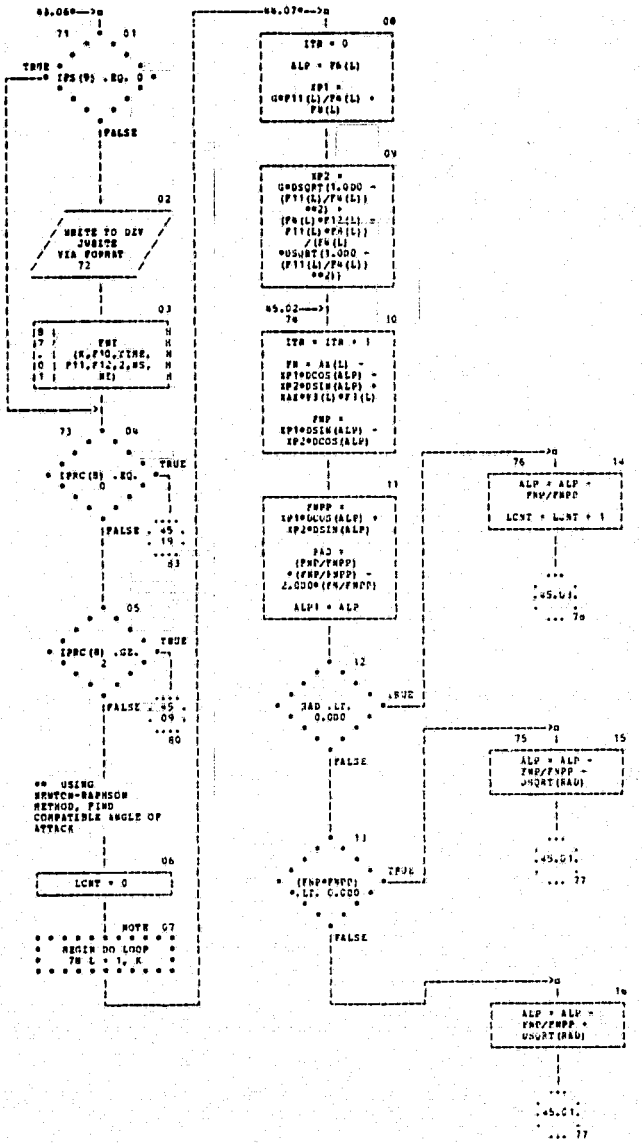
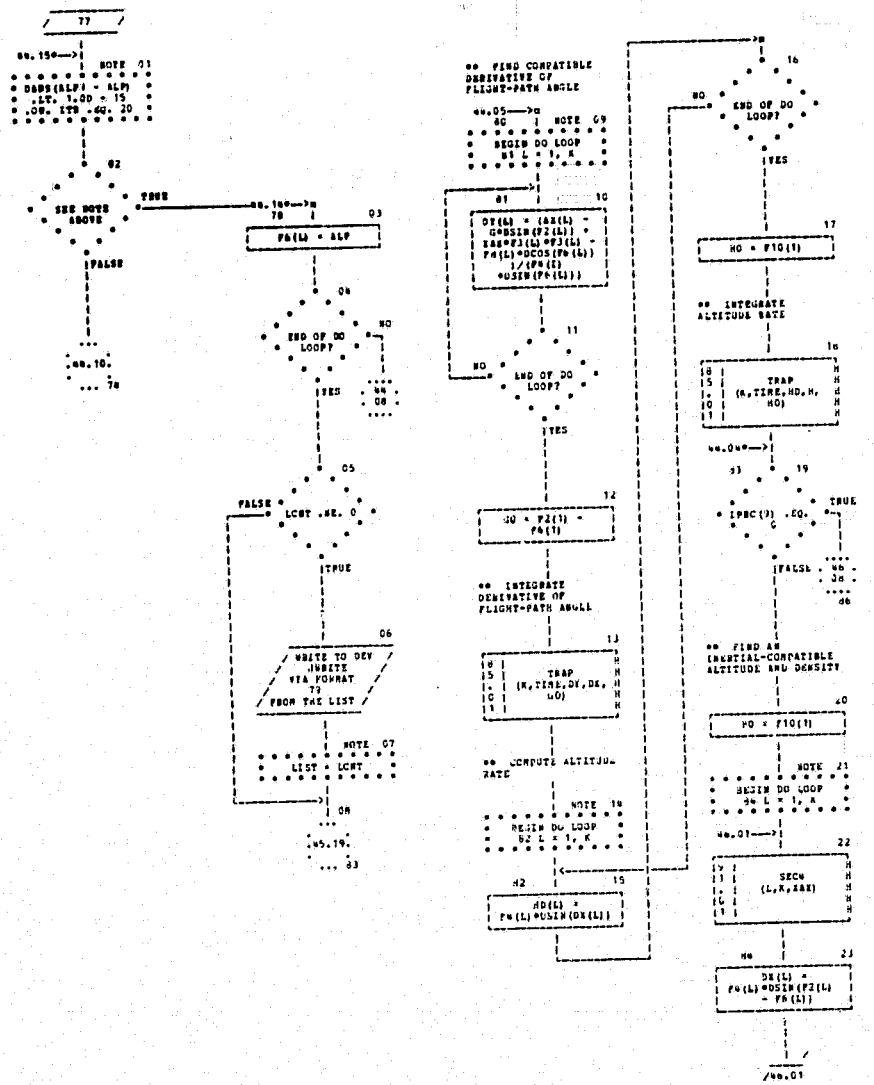
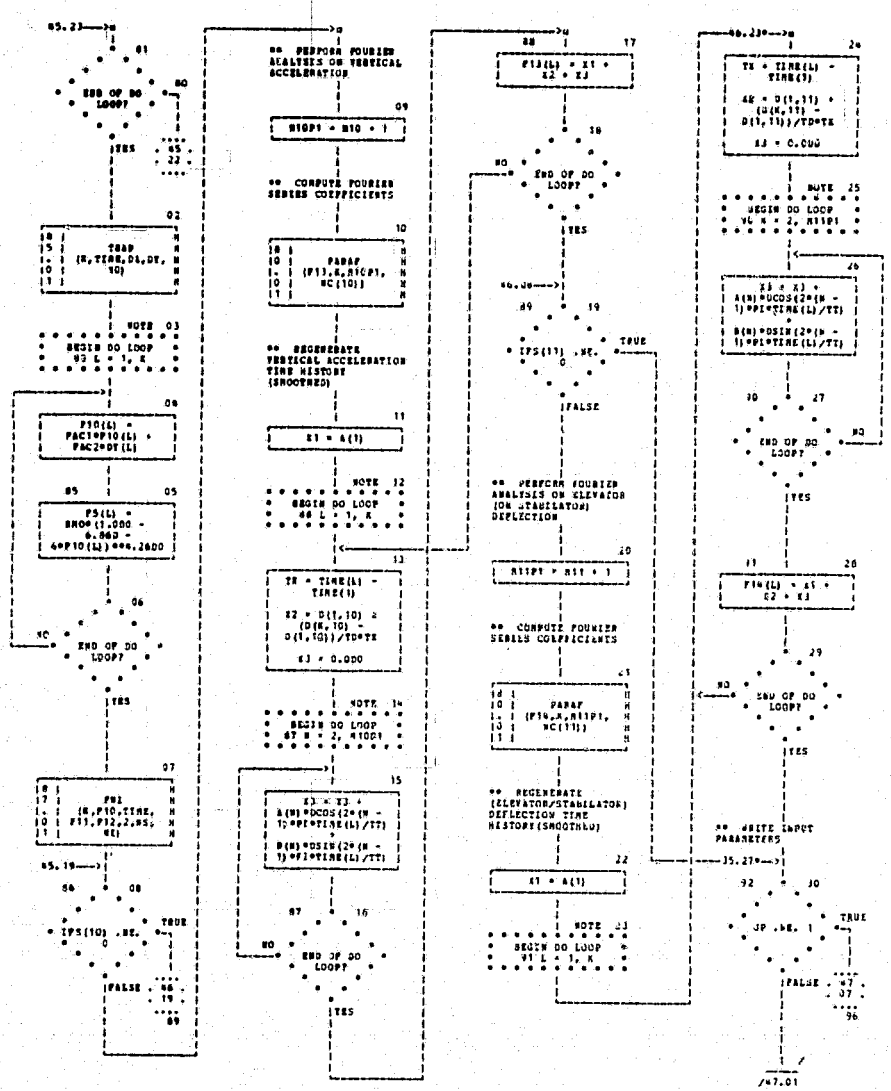


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CHART TITLE - SUBROUTINE SRC2(E,JP,HRR,LSP,ITEST,S)



C-4

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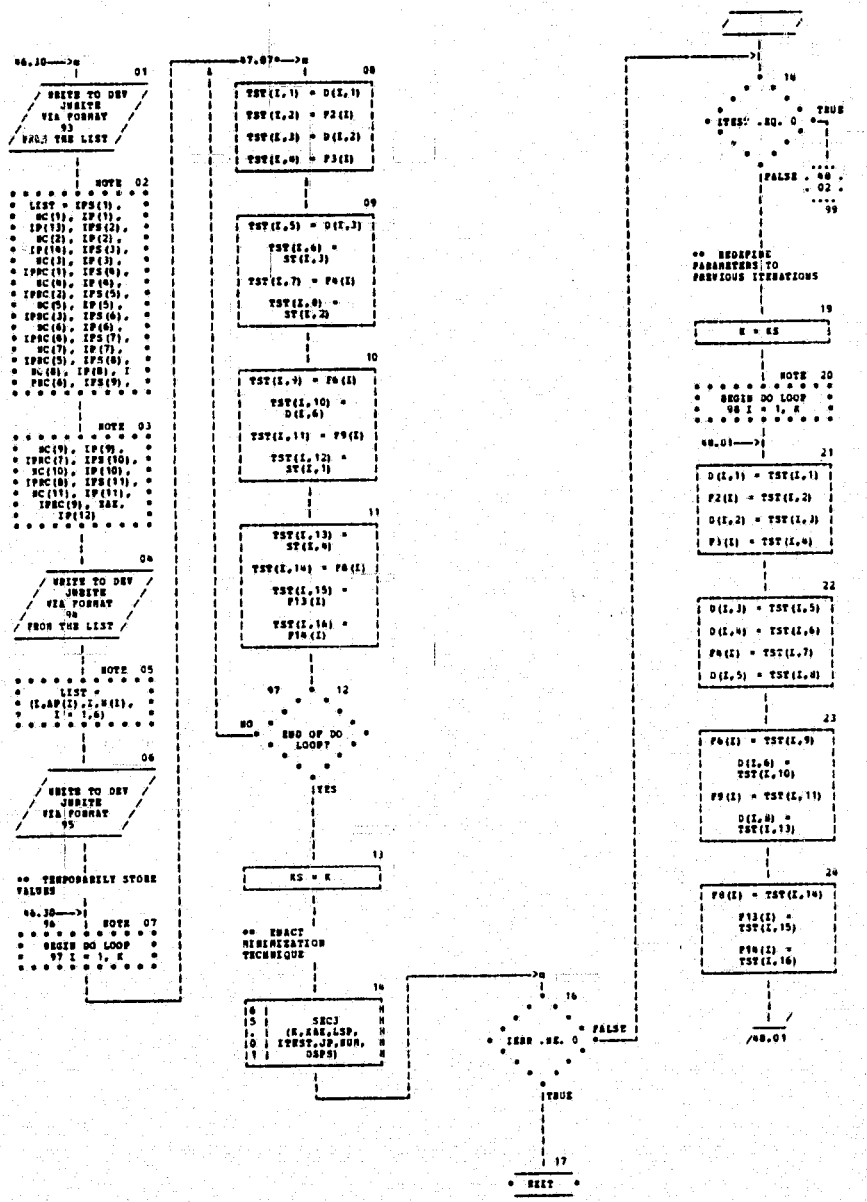
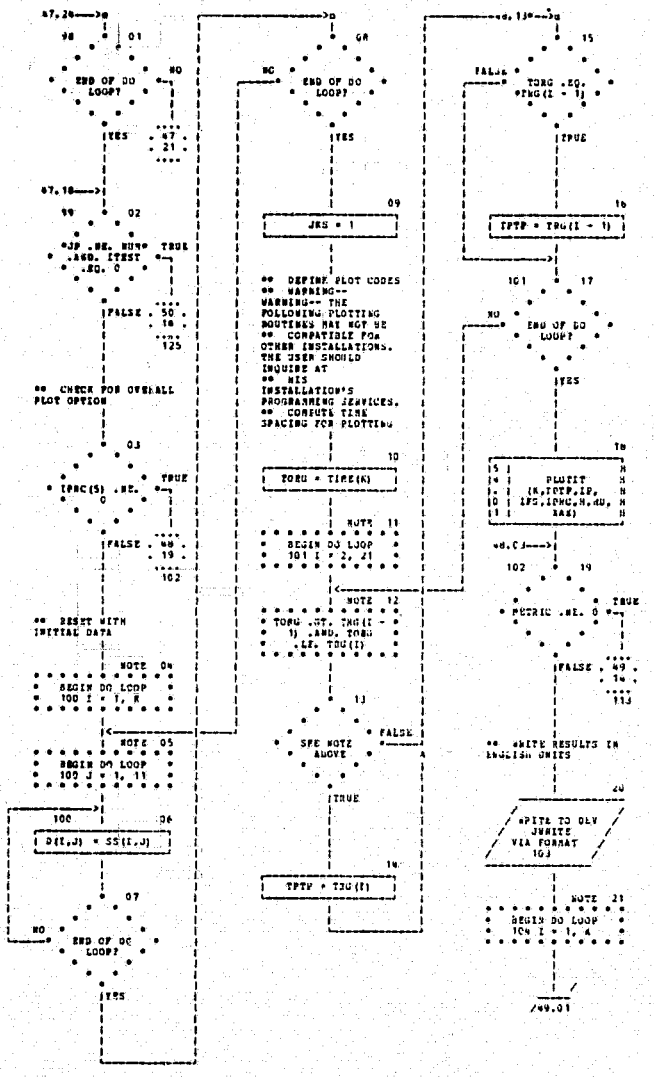
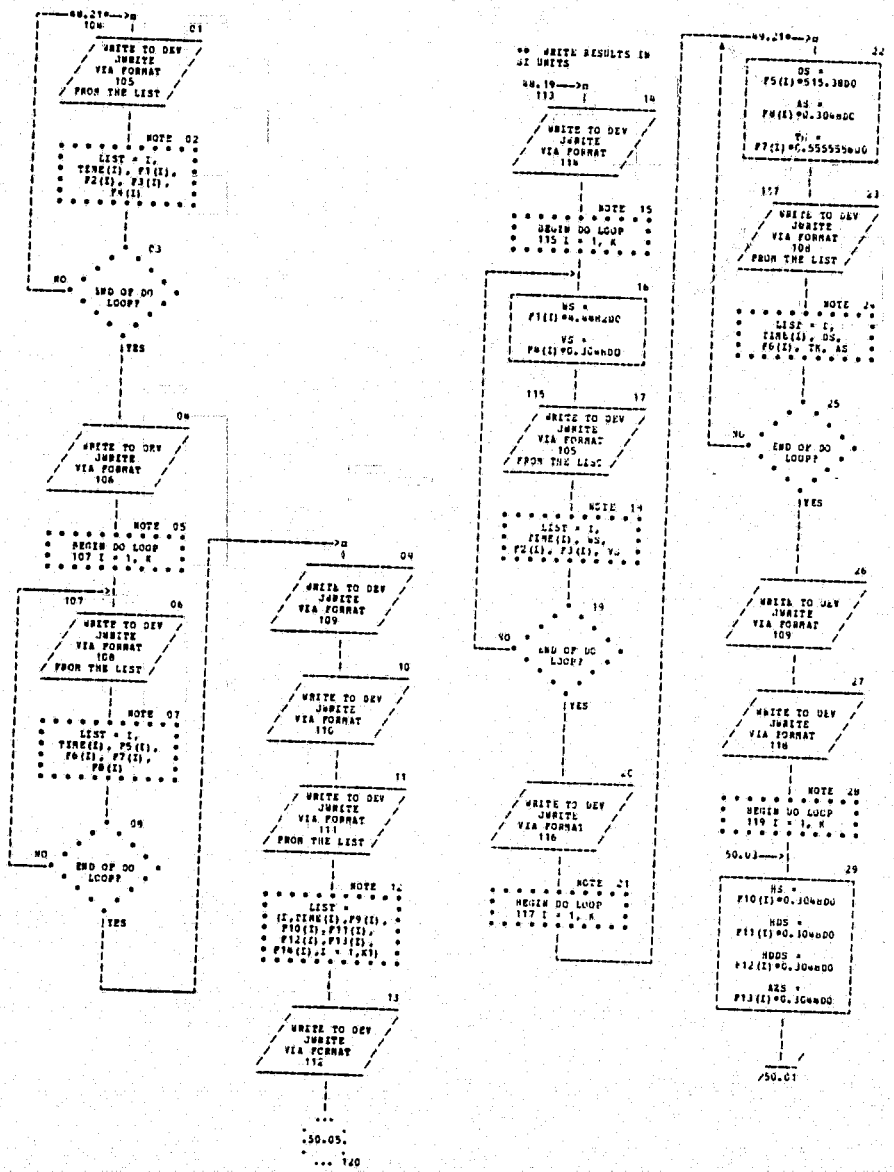


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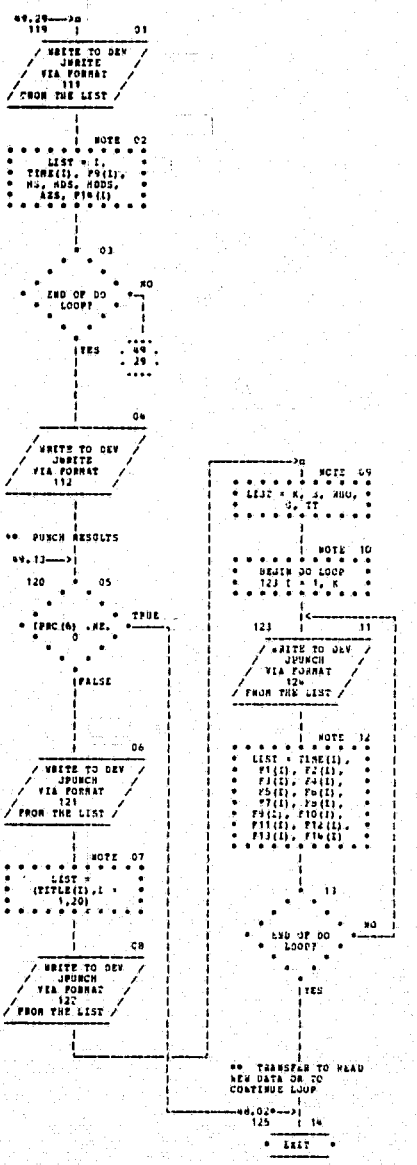
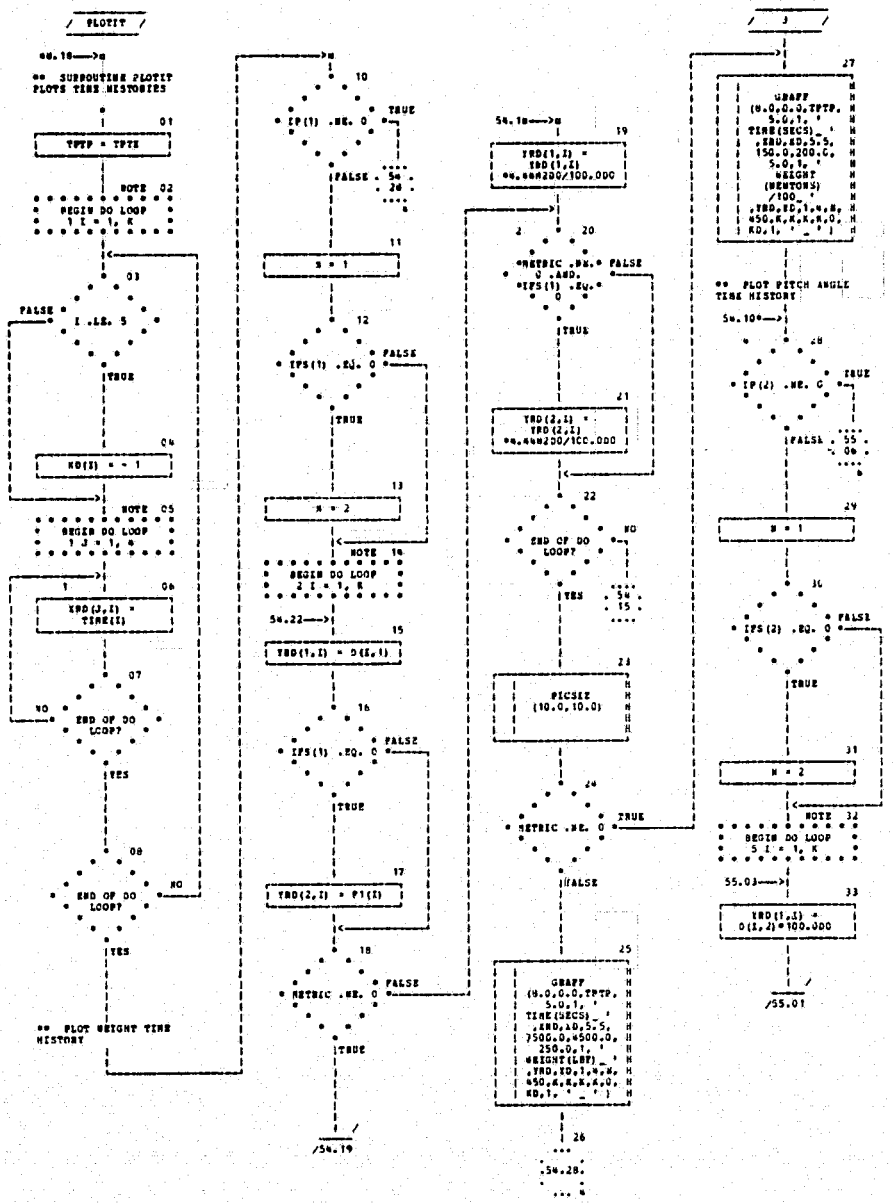


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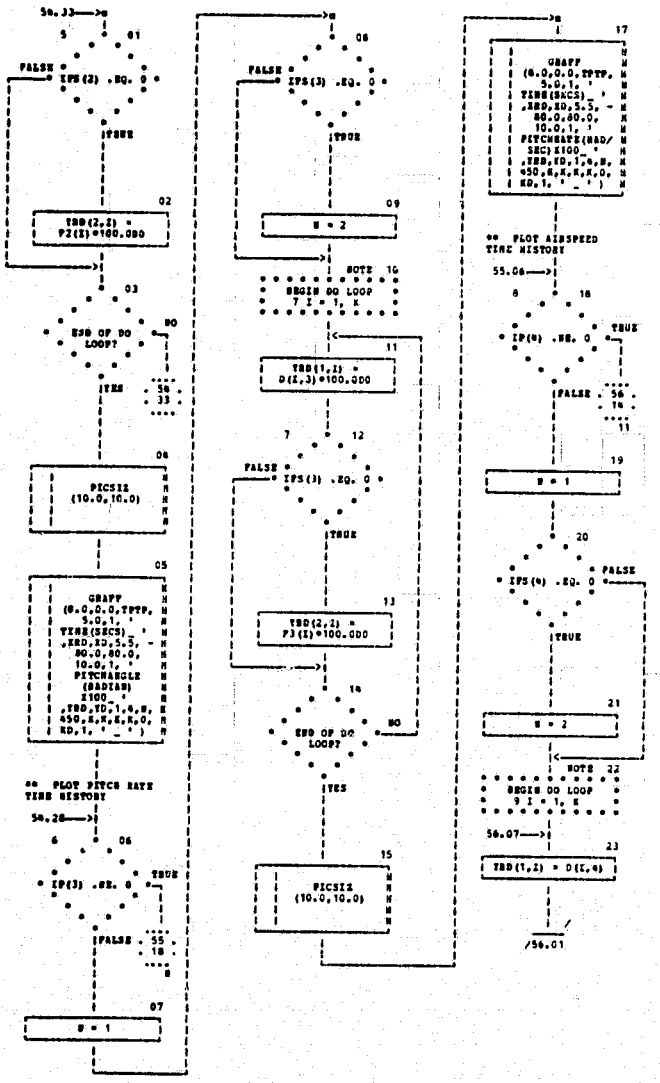
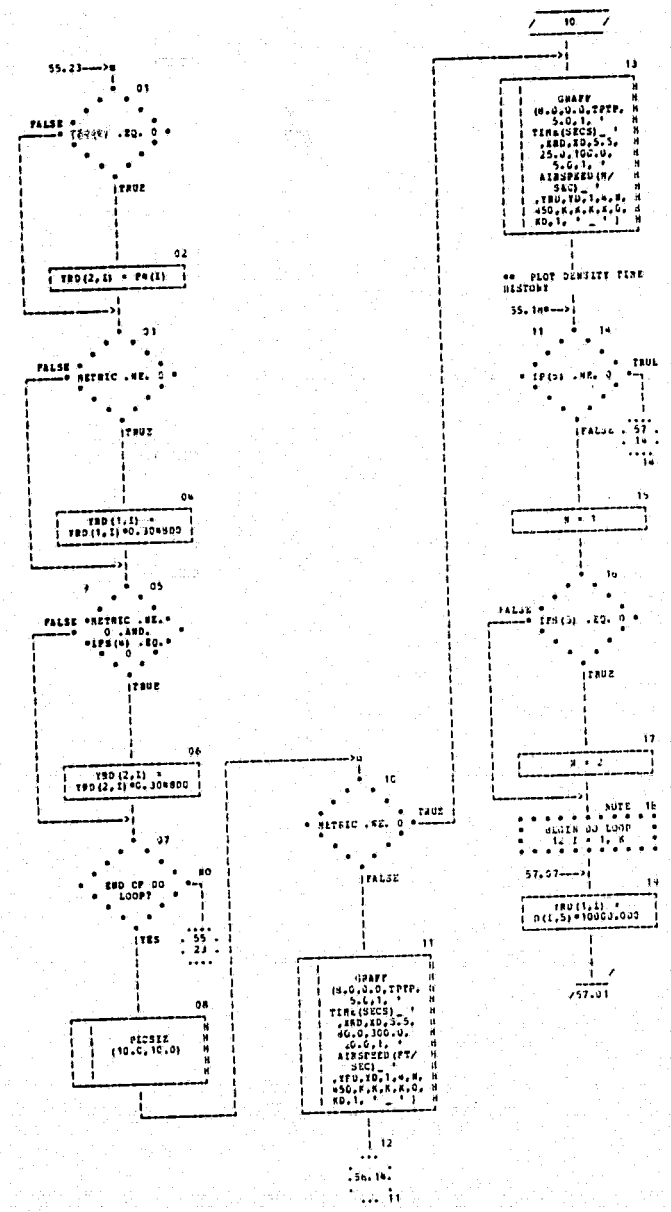


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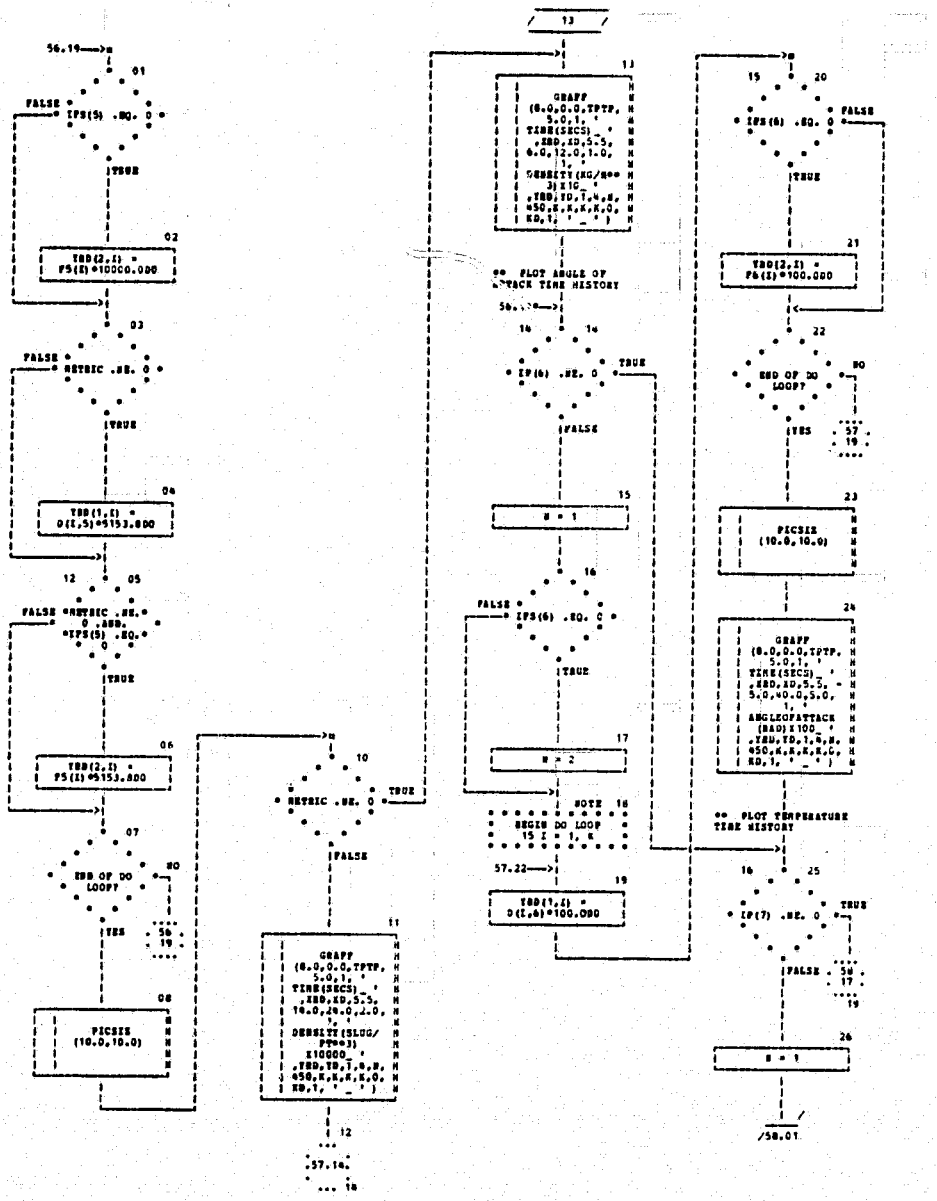
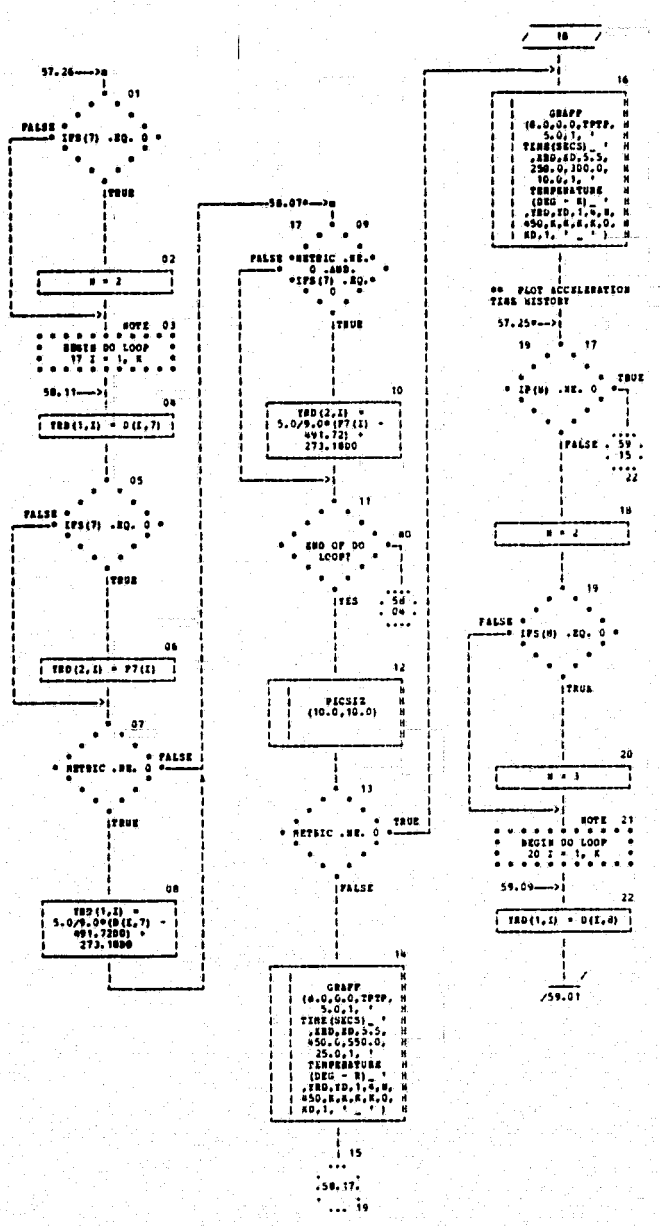


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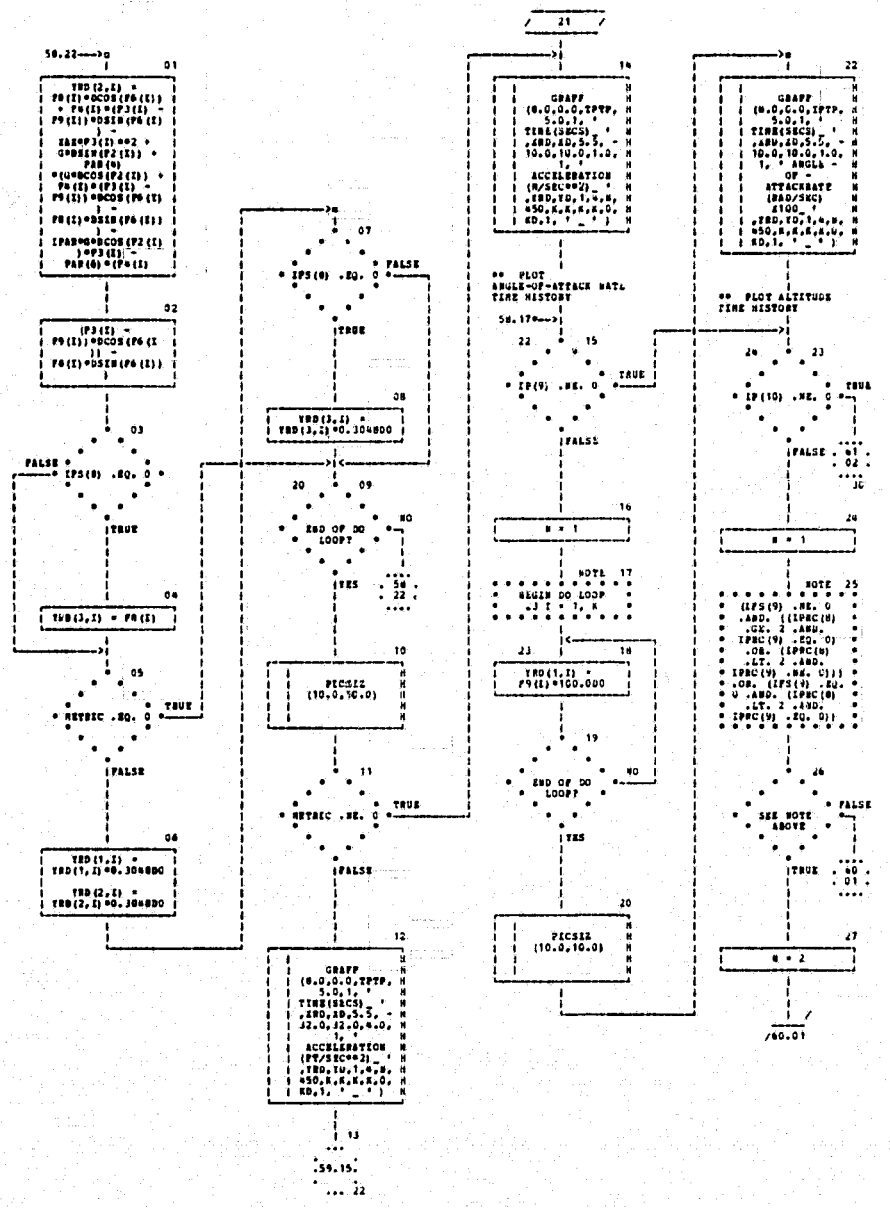
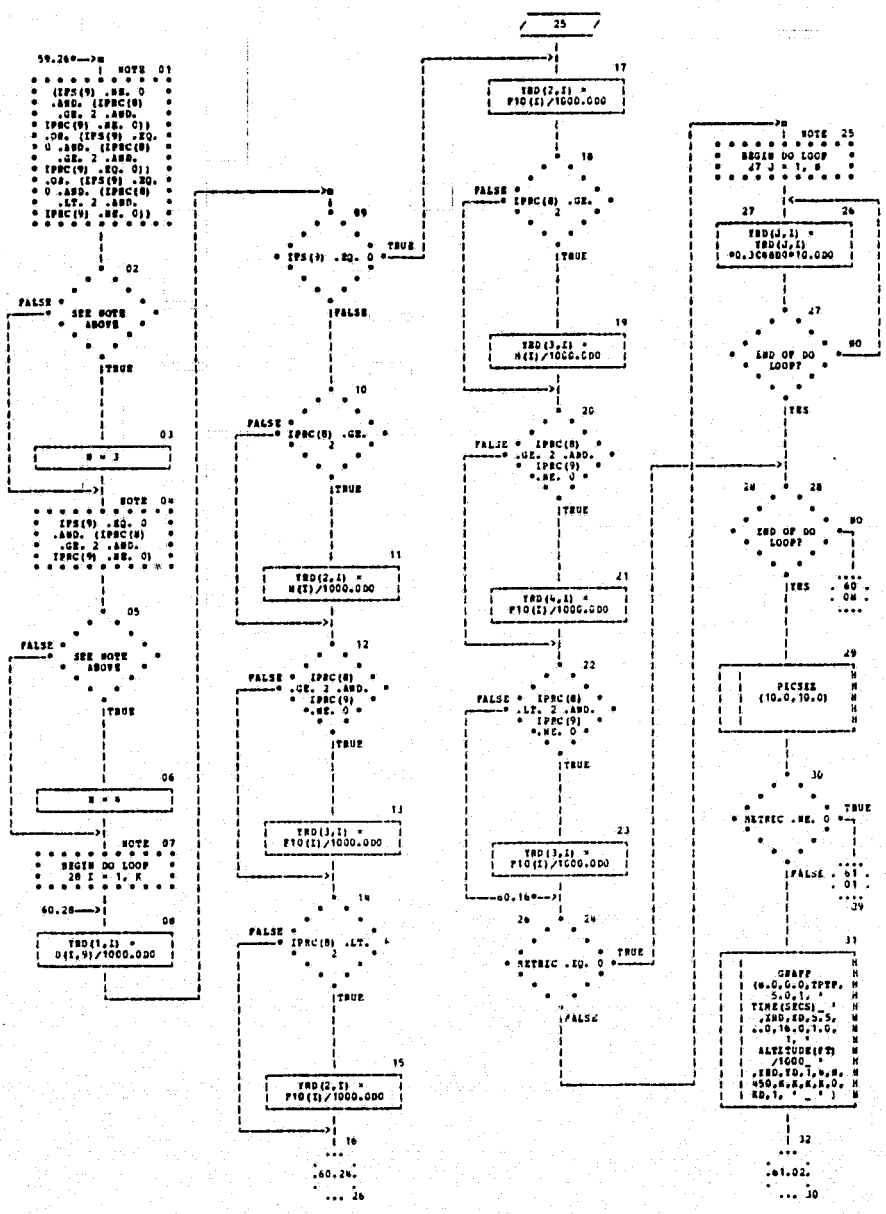


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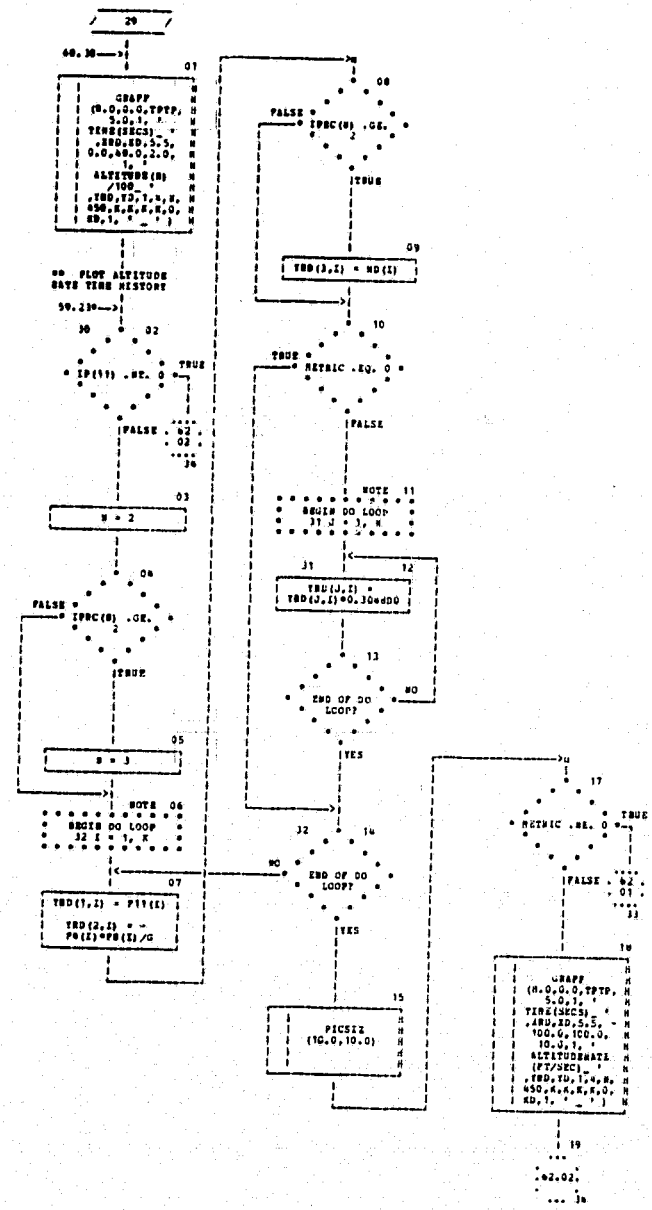
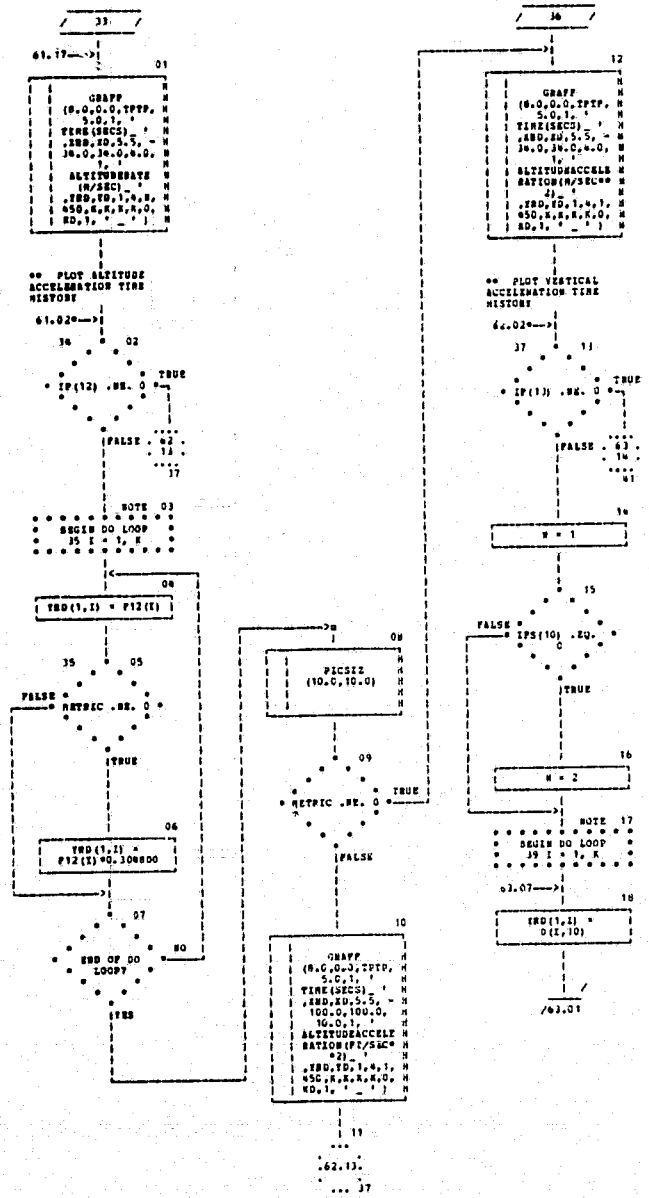
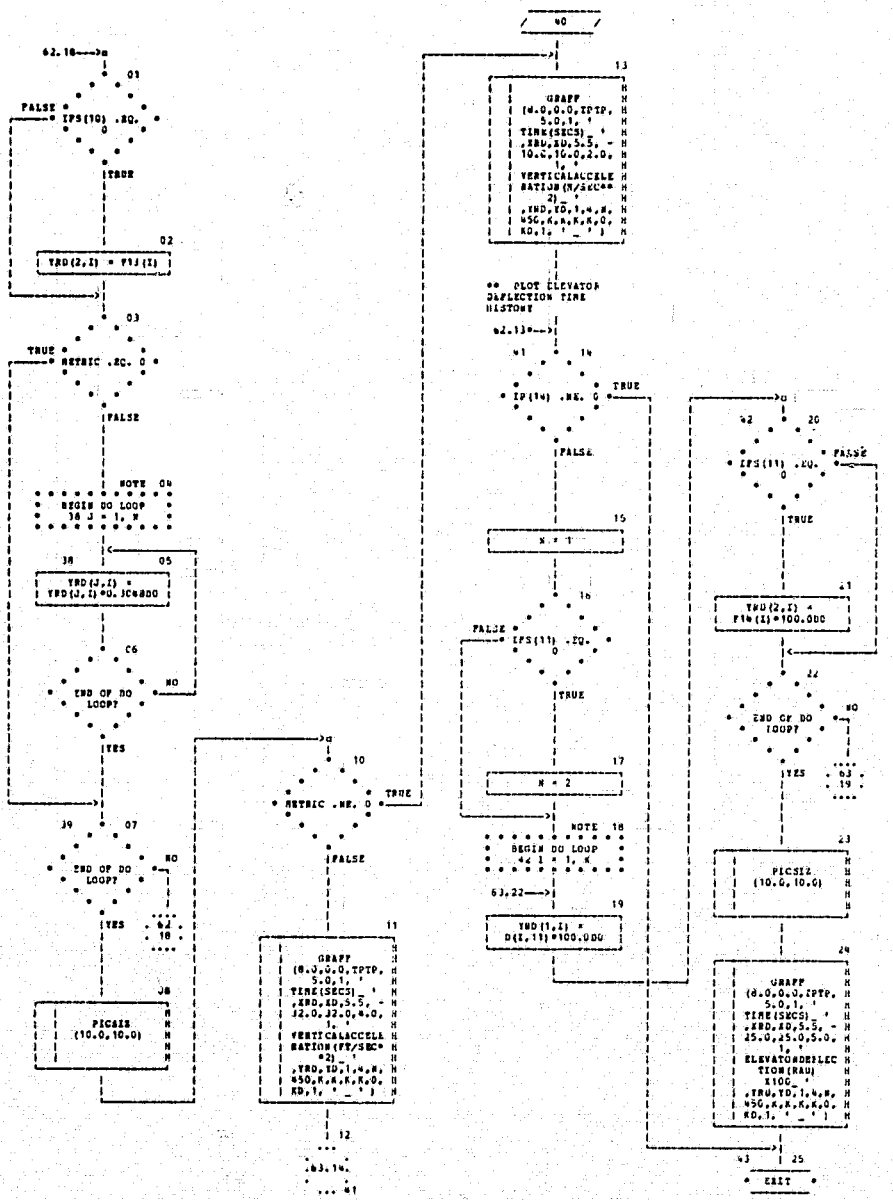


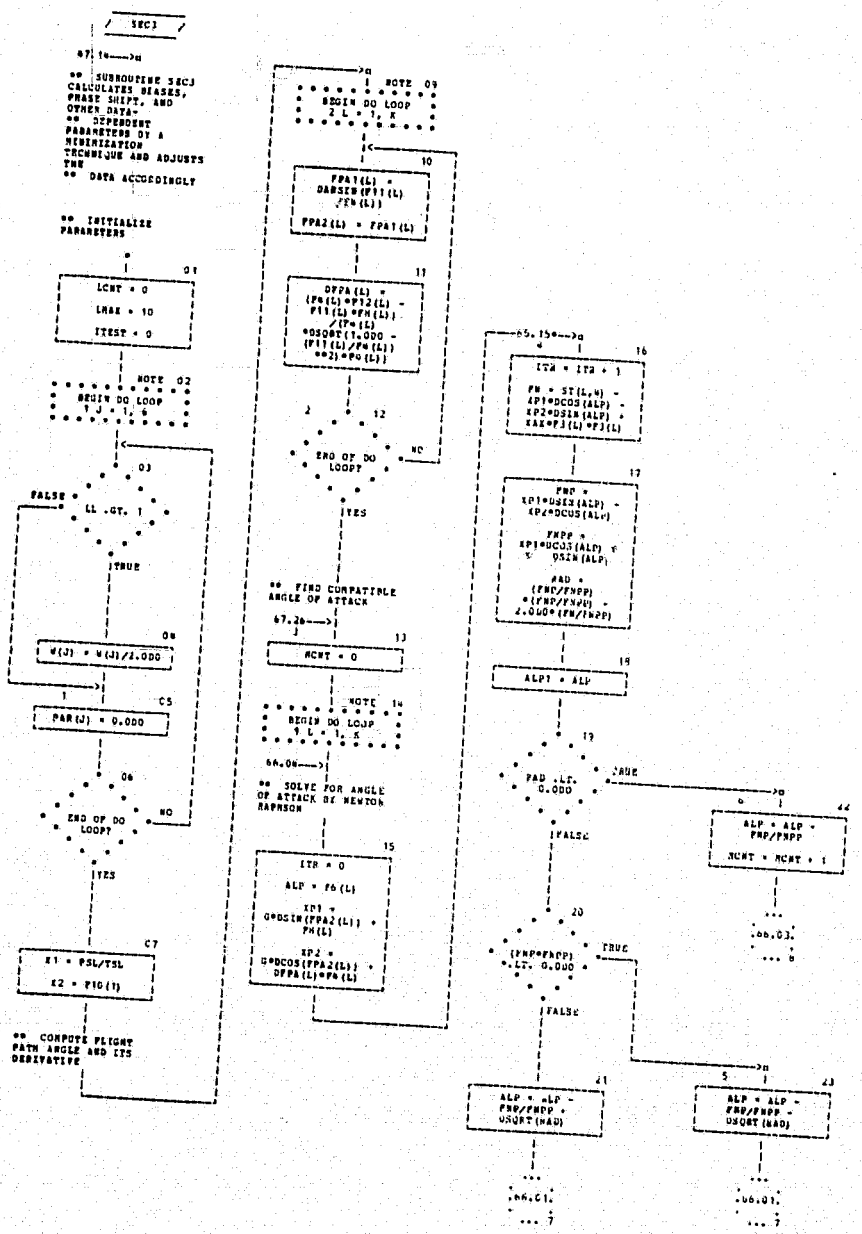
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CHART TITLE - SUBROUTINE PLOTEF(N,TPTX,IP,IFS,IPEC,M,MO,XAX)




SEC3
** SUBROUTINE SEC3 CALCULATES BIASES, PHASE SHIFT, AND OTHER DATA-
** DEPENDENT PARAMETERS BY A MINIMIZATION TECHNIQUE AND ADJUSTS THE
** DATA ACCORDINGLY
** INITIALIZE PARAMETERS
01
LCNT = 0
LMAX = 10
ITEST = 0
NOTE 02
BEGIN DO LOOP
J = 1, 6
03
LL .GT. 1
FALSE
TRUE
04
W(J) = W(J)/2.000
05
PAR(J) = 0.000
06
END OF DO LOOP?
NO
YES
07
XI = PSL/TSL
X2 = P10(1)
** COMPUTE FLIGHT PATH ANGLE AND ITS DERIVATIVE
NOTE 09
BEGIN DO LOOP
L = 1, K
10
FPA1(L) = DARSIN(P11(L) /PH(L))
FPA2(L) = FPA1(L)
11
DFPA(L) = (P6(L)*P12(L) - P11(L)*PH(L)) /(P*(L) *DSQRT(1.000 - (P11(L)/P6(L)) **2)*P6(L))
12
END OF DO LOOP?
NO
YES
** FIND COMPATIBLE ANGLE OF ATTACK
67.20
13
NCNT = 0
NOTE 14
BEGIN DO LOOP
L = 1, 5
66.06
** SOLVE FOR ANGLE OF ATTACK BY NEWTON RAPHSON
15
ITR = 0
ALP = P6(L)
XP1 = G*DSIN(FPA2(L)) + PH(L)
XP2 = G*DCOS(FPA2(L)) - DFPA(L)*P6(L)
65.15
16
ITR = ITR + 1
FN = ST(L,4) - XP1*DCOS(ALP) - XP2*DSIN(ALP) + XAX*P3(L) *P3(L)
17
FNP = XP1*DSIN(ALP) - XP2*DCOS(ALP)
FNPP = XP1*DCOS(ALP) + DSIN(ALP)
RAD = (FNP/FNPP) *(FNP/FNPP) - 2.000*(FN/FNPP)
18
ALP1 = ALP
19
RAD .LT. 0.000
TRUE
FALSE
44
ALP = ALP - FNP/FNPP
NCNT = NCNT + 1
66.03
20
(FNP*FNPP) .LT. 0.000
TRUE
FALSE
21
ALP = ALP - FNP/FNPP + DSQRT(RAD)
66.01
23
ALP = ALP - FNP/FNPP - DSQRT(RAD)
66.01

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CHART TITLE - SUBROUTINE SEC3(K,XAX,LSP,ITEST,LL,NUR,DSPS)

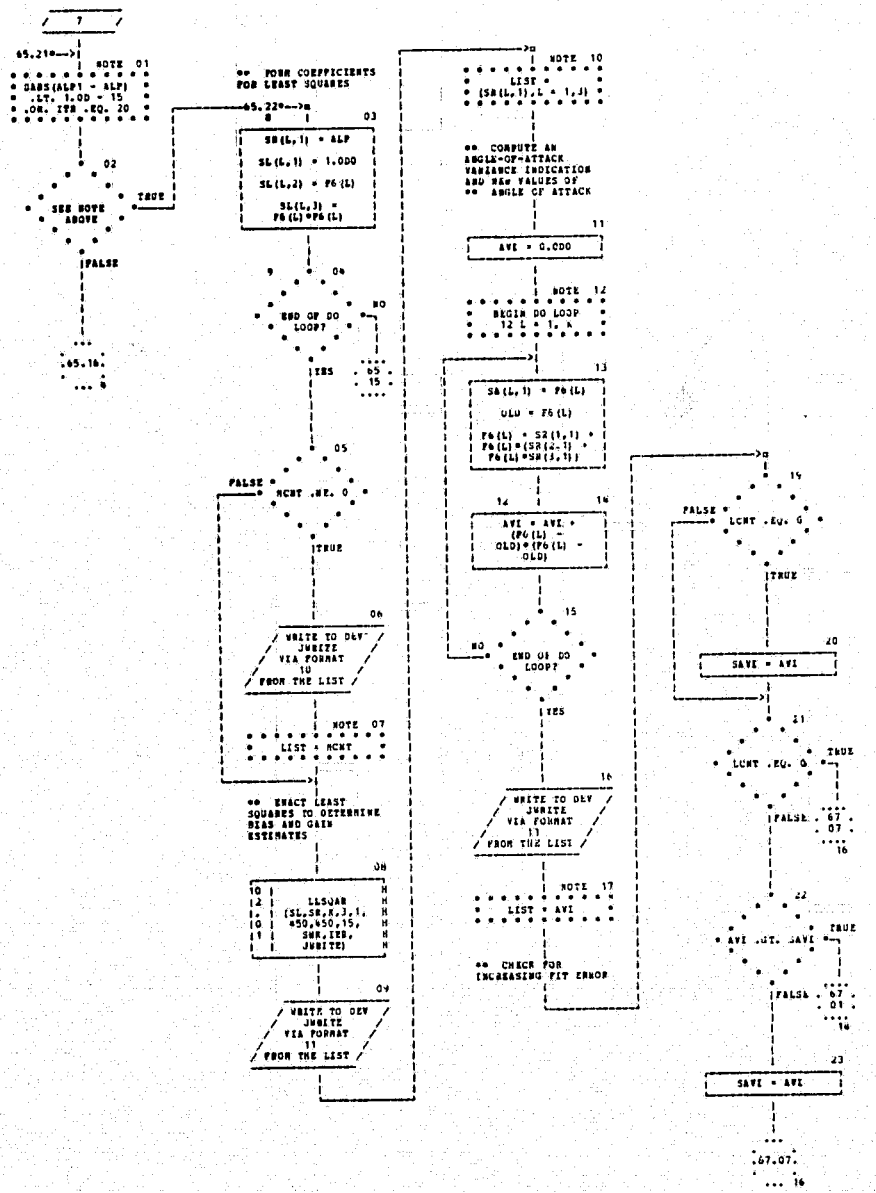
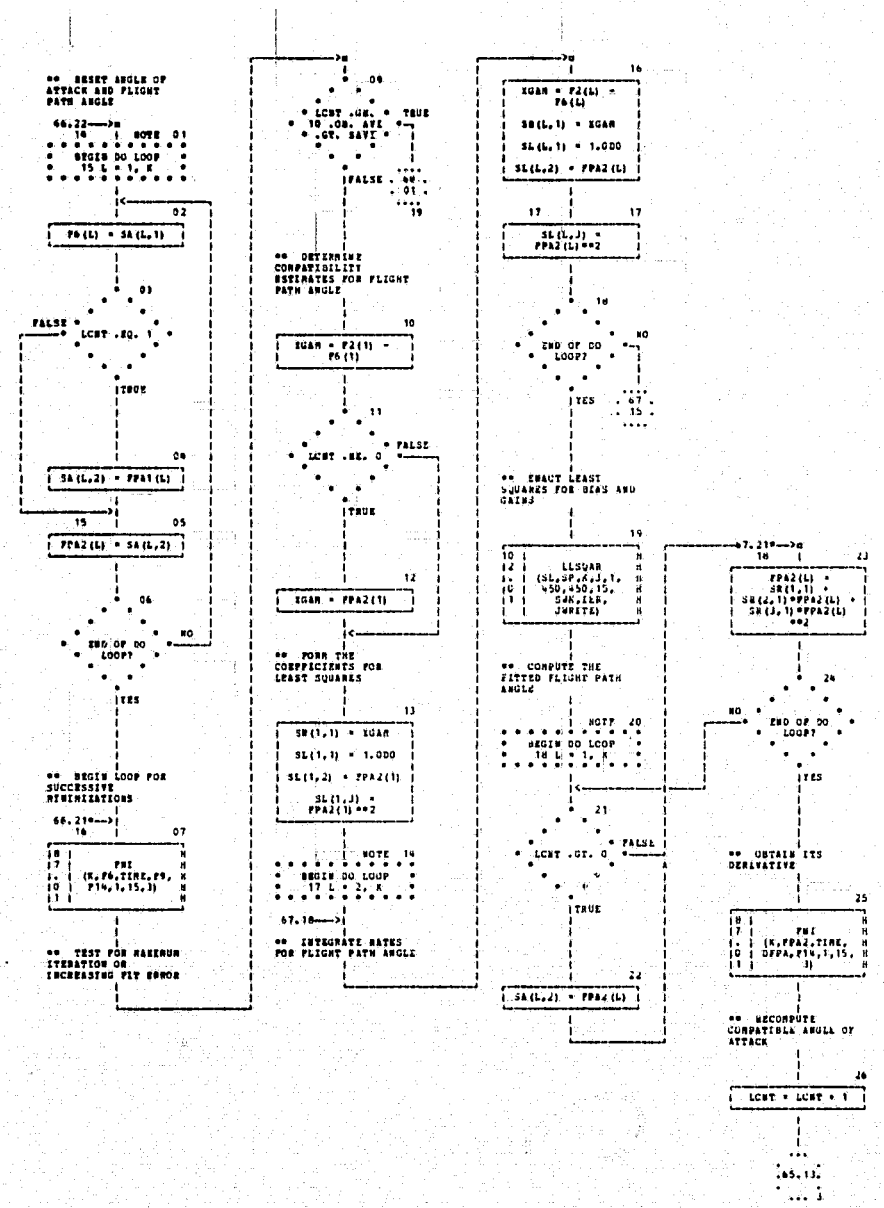


CHART TITLE - SUBROUTINE SEC3(K,EAI,LSP,ITEST,LL,RUN,DSPS)



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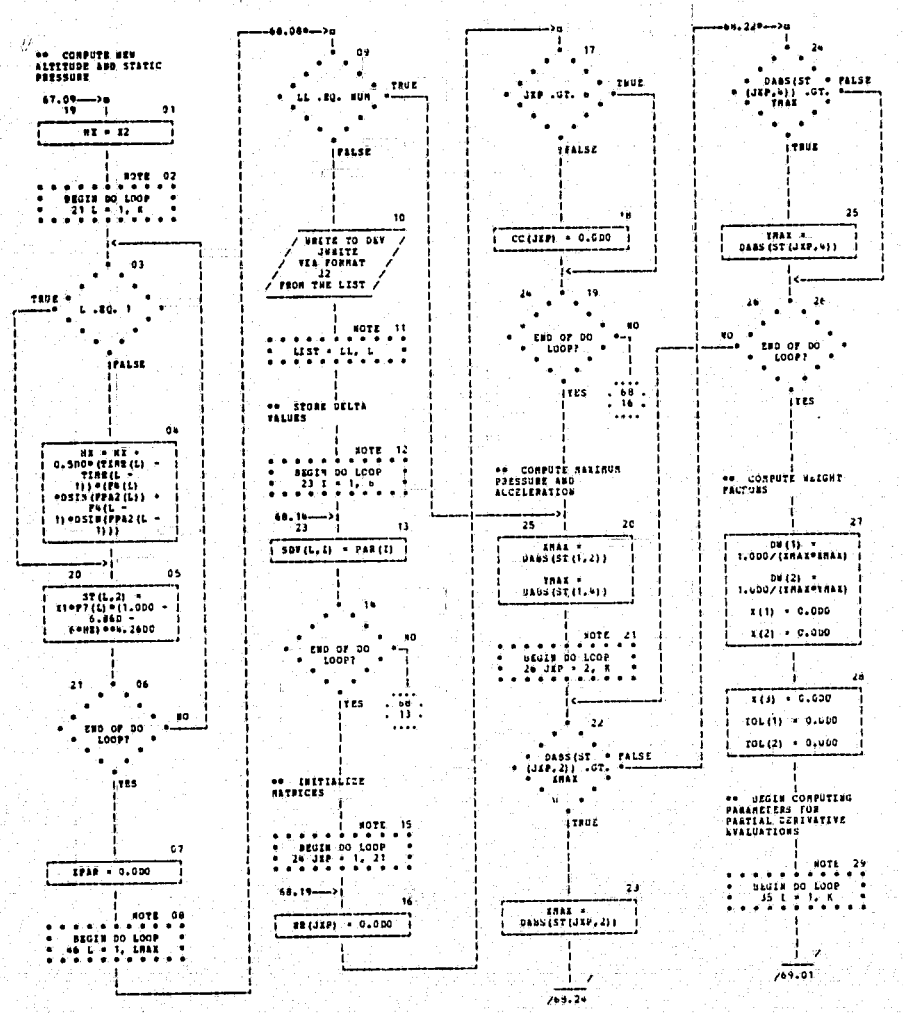
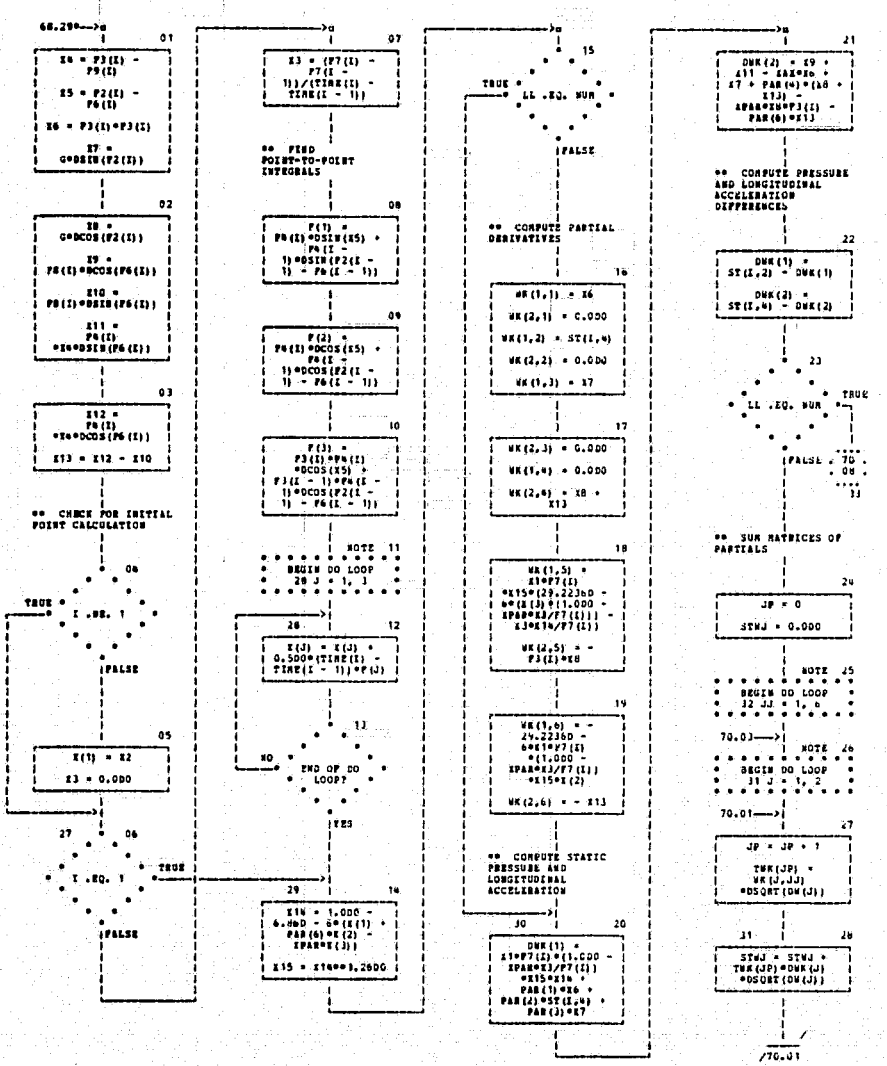


CHART TITLE - SUBROUTINE SECJ(N,XAX,LSP,ITEST,LL,SUM,DSPS)



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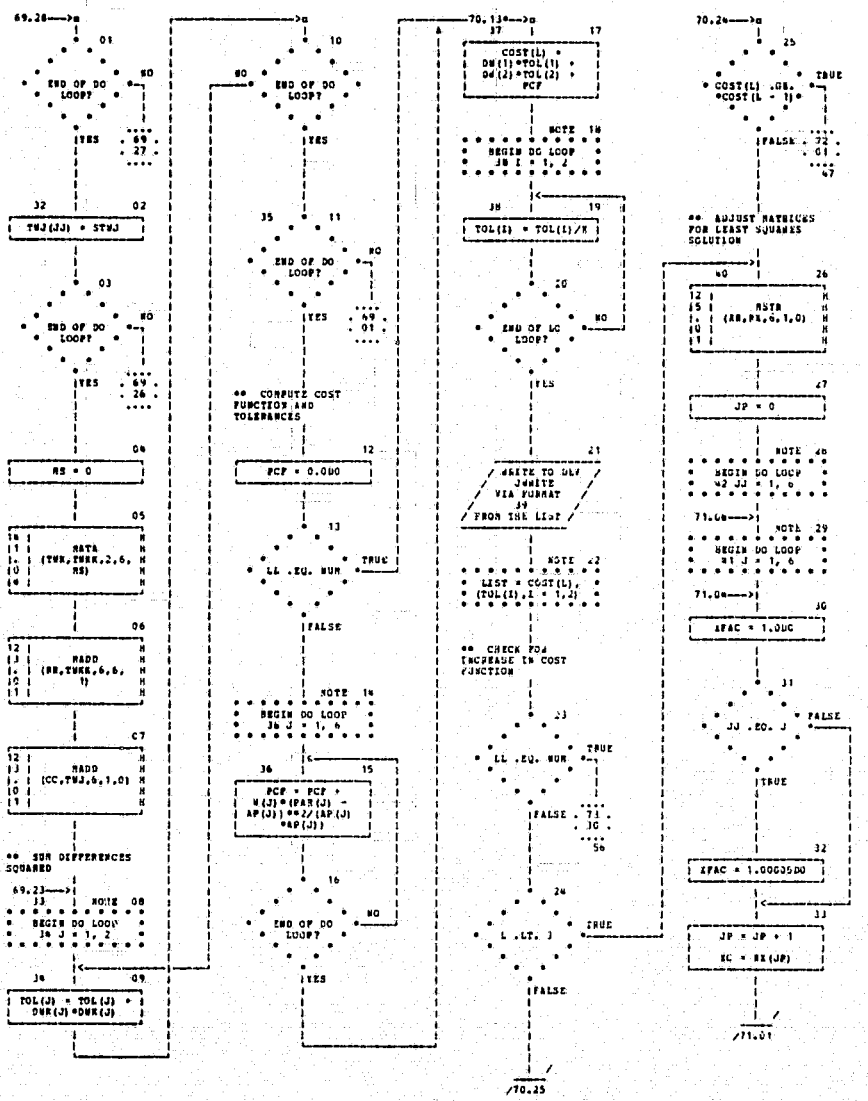
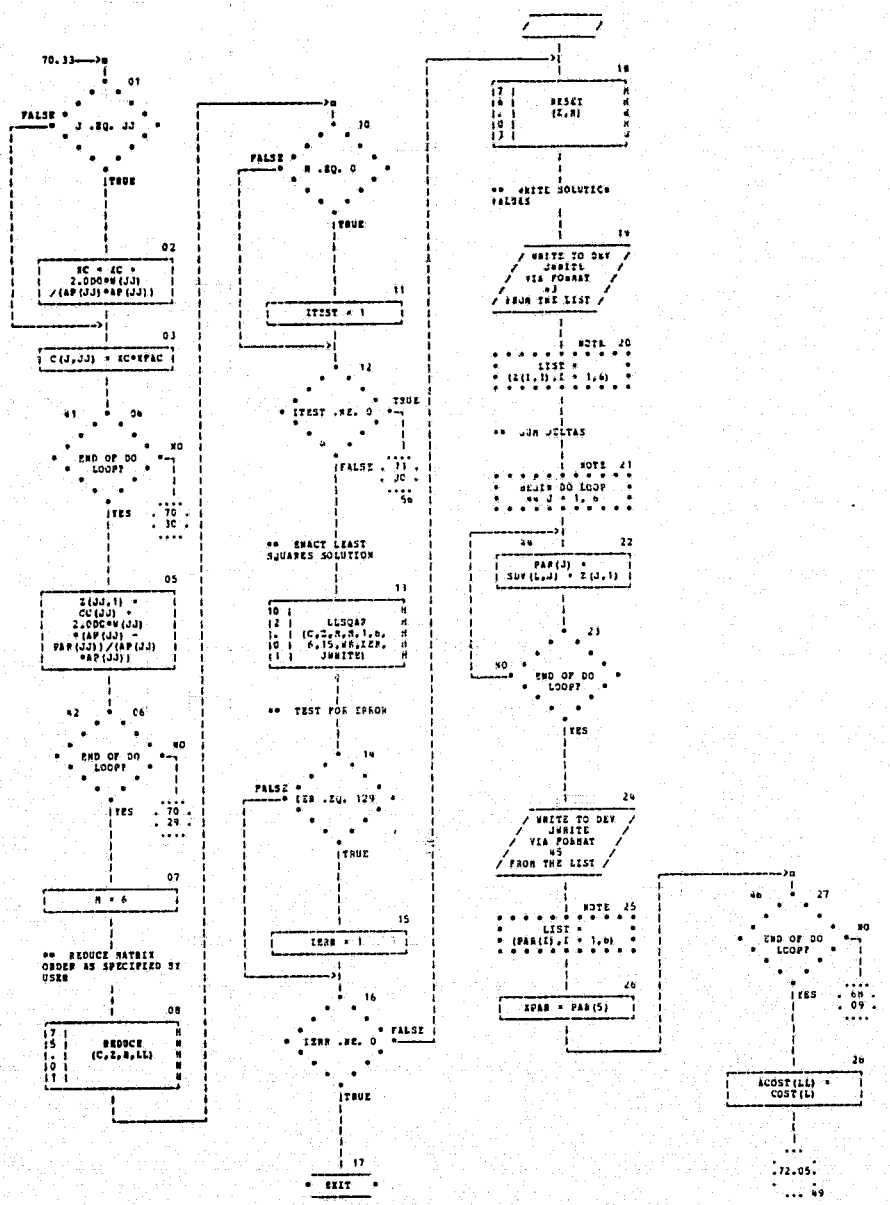


CHART TITLE - SUBROUTINE SMC3(N,NAX,LSP,ITEST,LL,NUM,DSPS)



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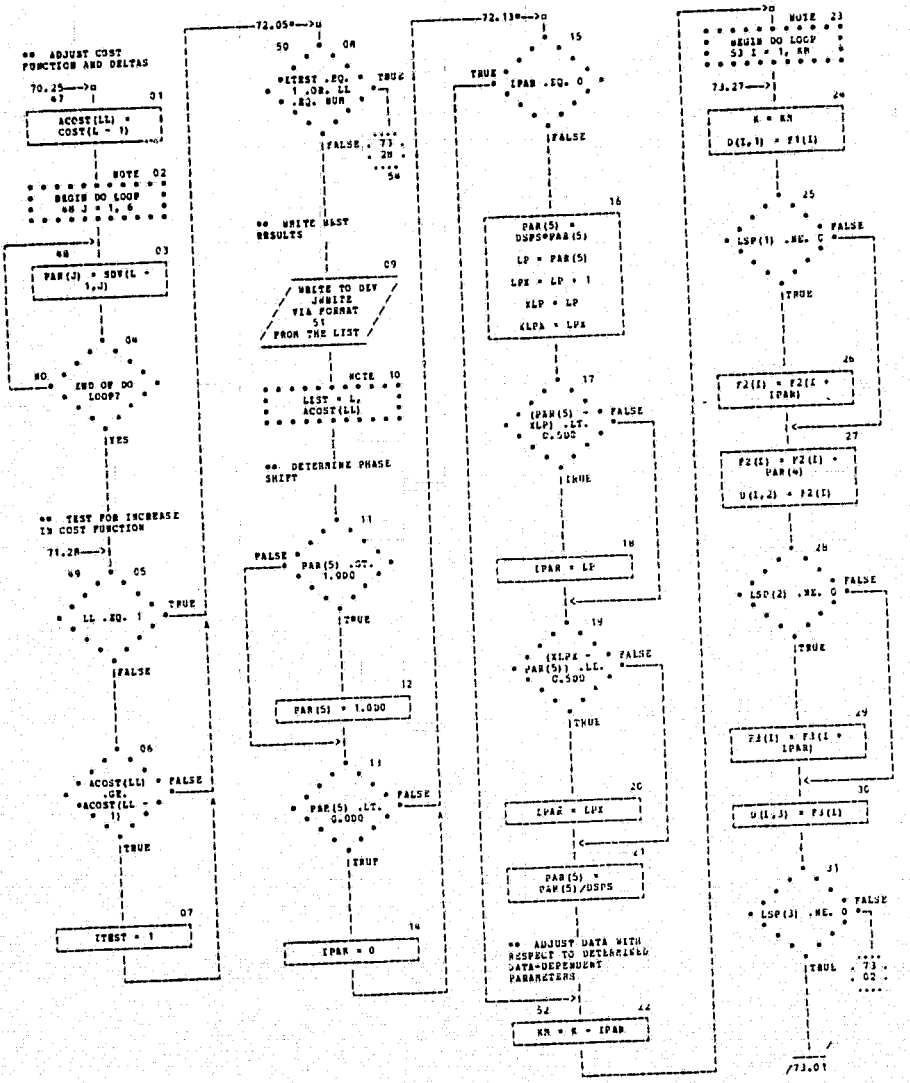
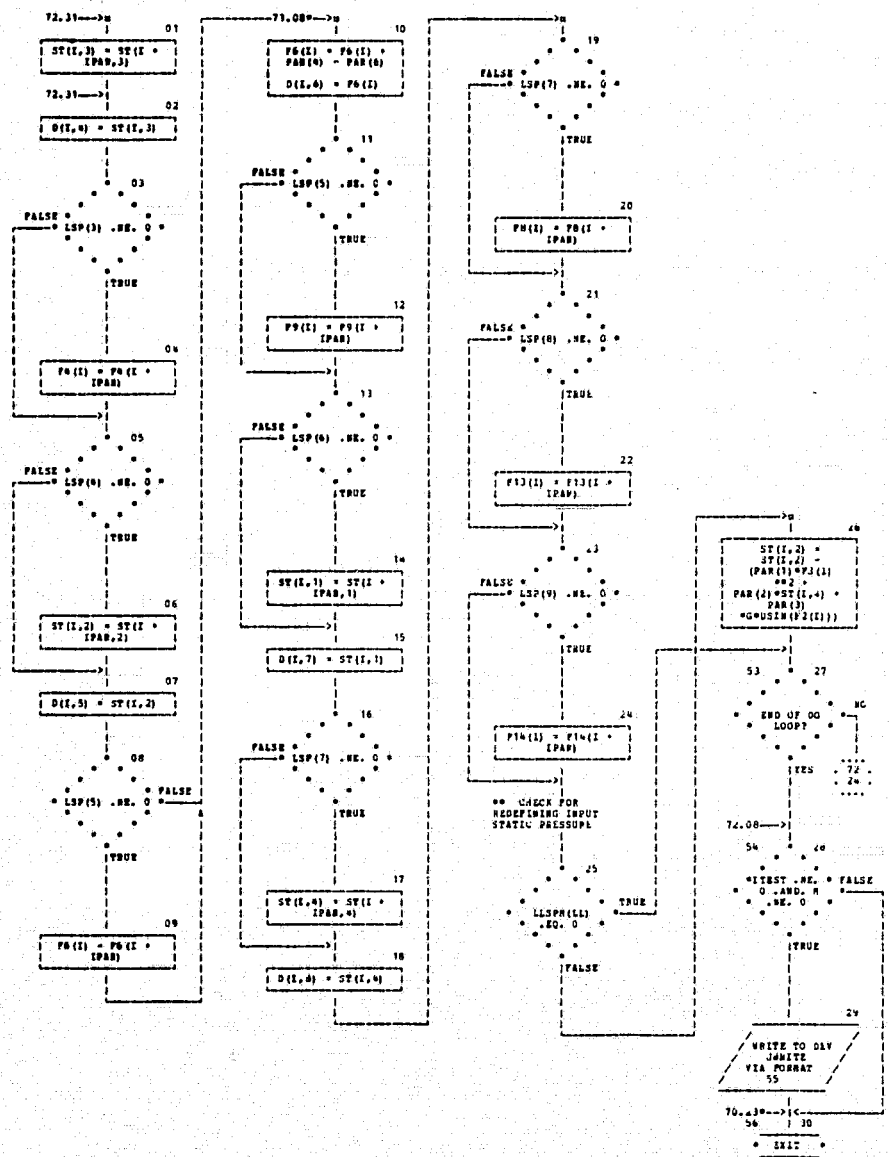


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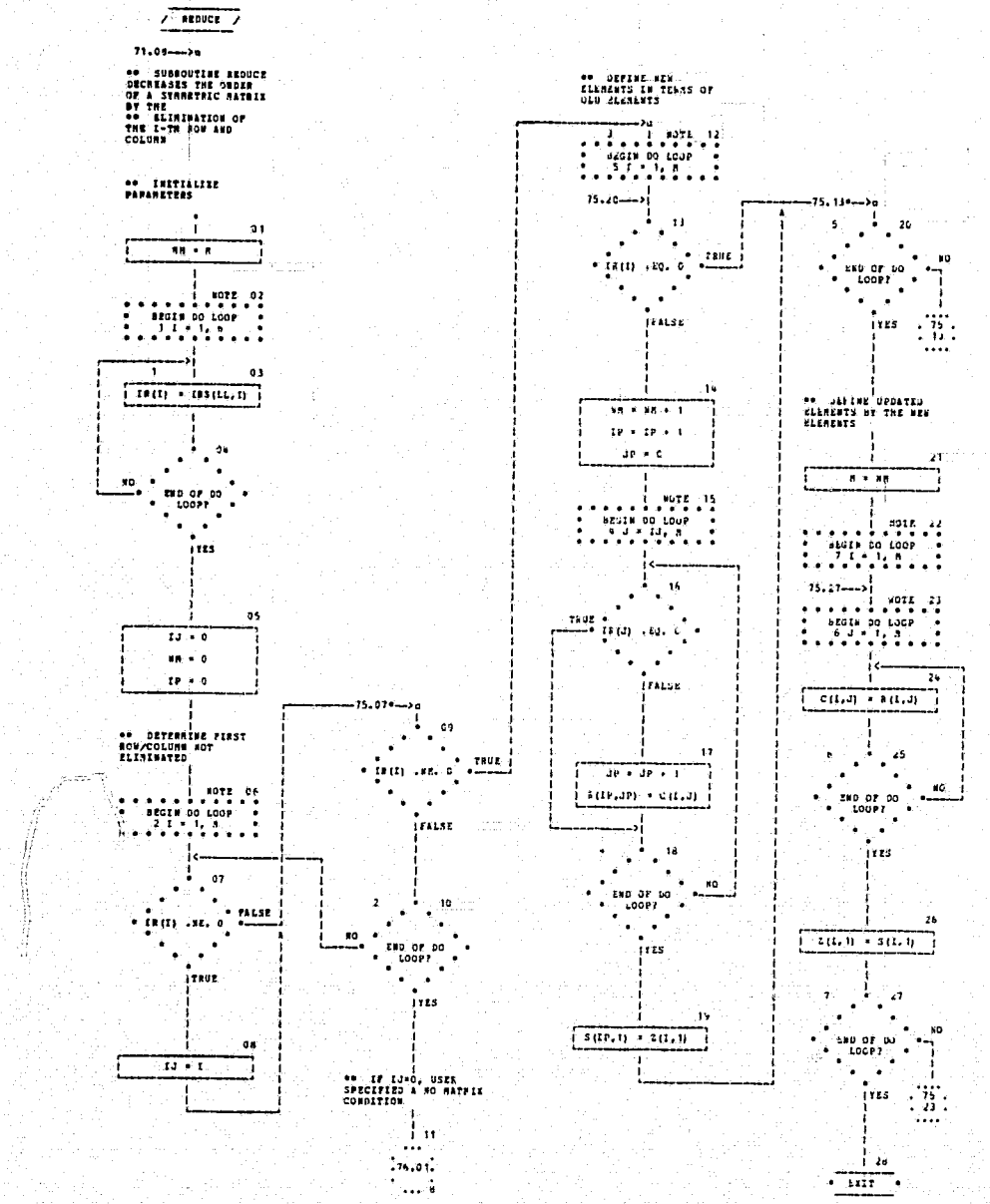
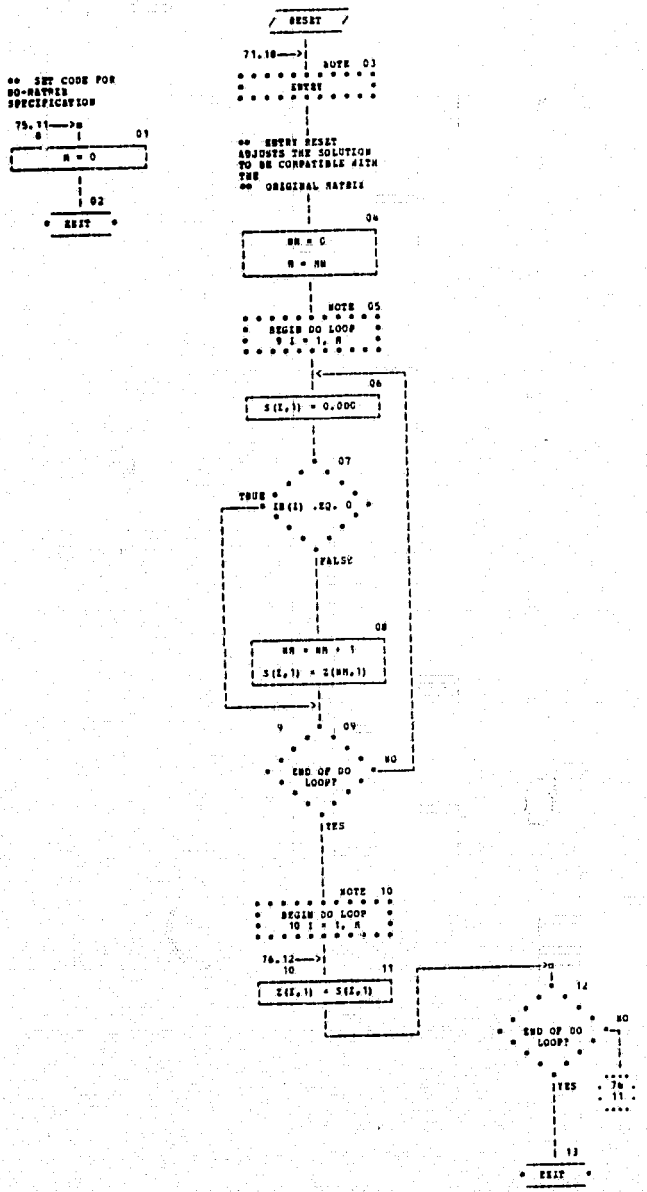


CHART TITLE - SUBROUTINE REDUCE(C,Z,N,LL)



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CHART TITLE - SUBROUTINE SHIFT(R,LSP,NSPTS)

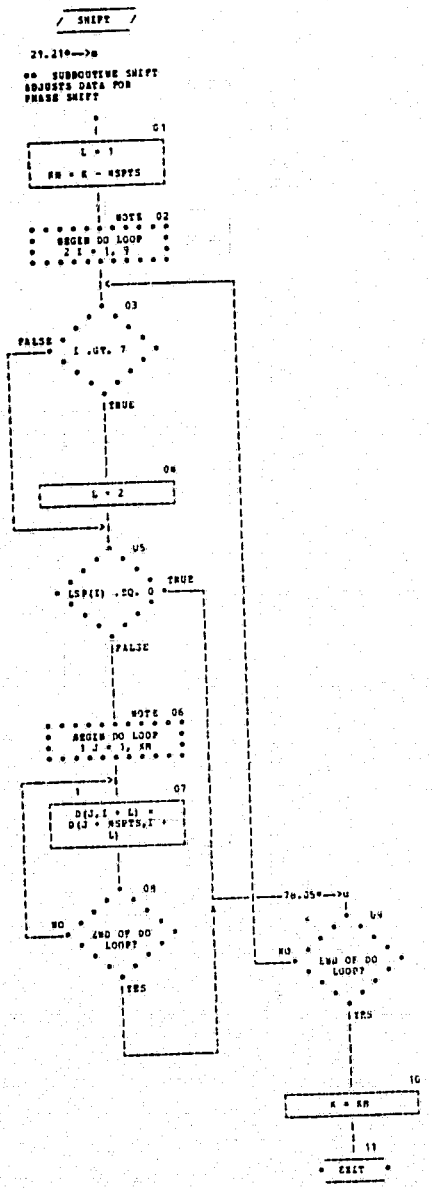
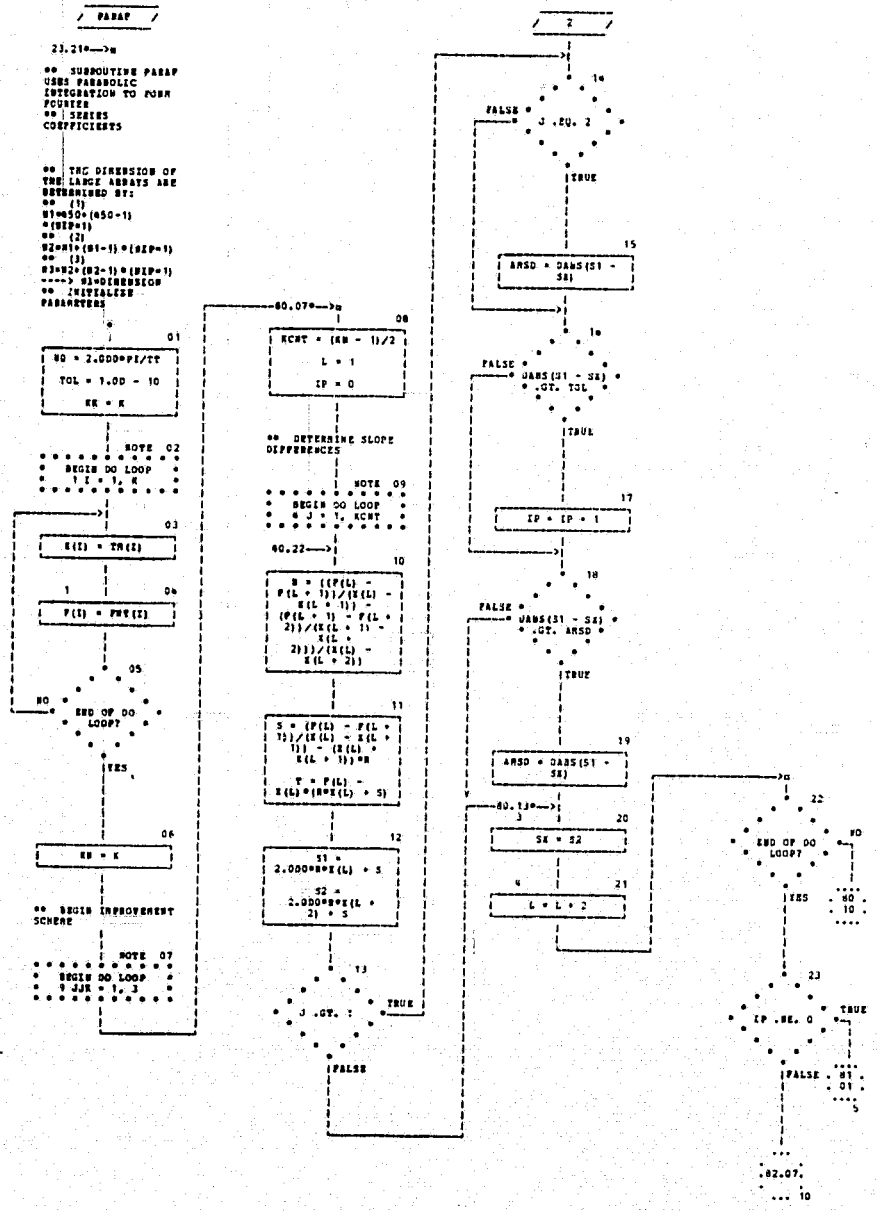
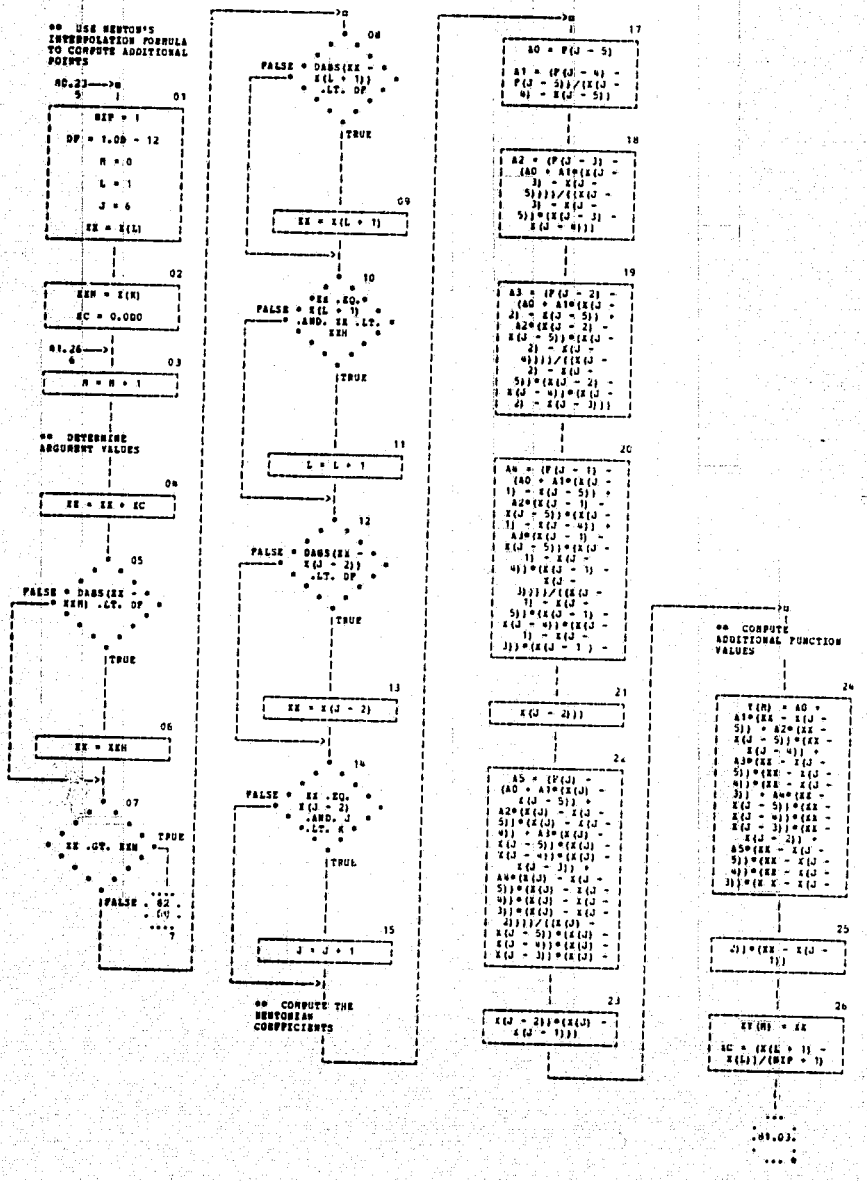


CHART TITLE - SUBROUTINE PARAP(PWT,K,RP1,8C)

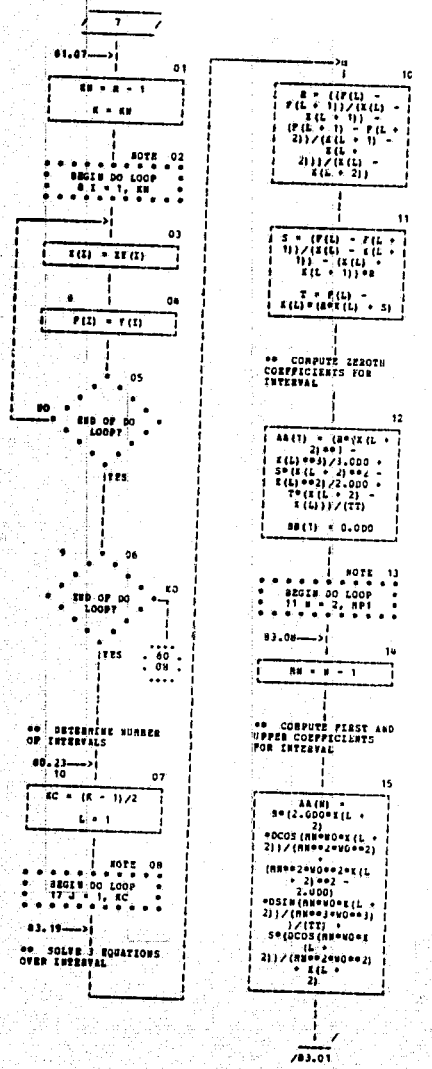


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OF POOR QUALITY



AUTOFLOW CHART SET - *PRR1 PAGE 02

CHART TITLE - SUBROUTINE PREAP(PHI,K,NP1,NC)



ORIGINAL PAGE IS
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CHART TITLE - SUBROUTINE PARAP(FST,K,NP1,NC)

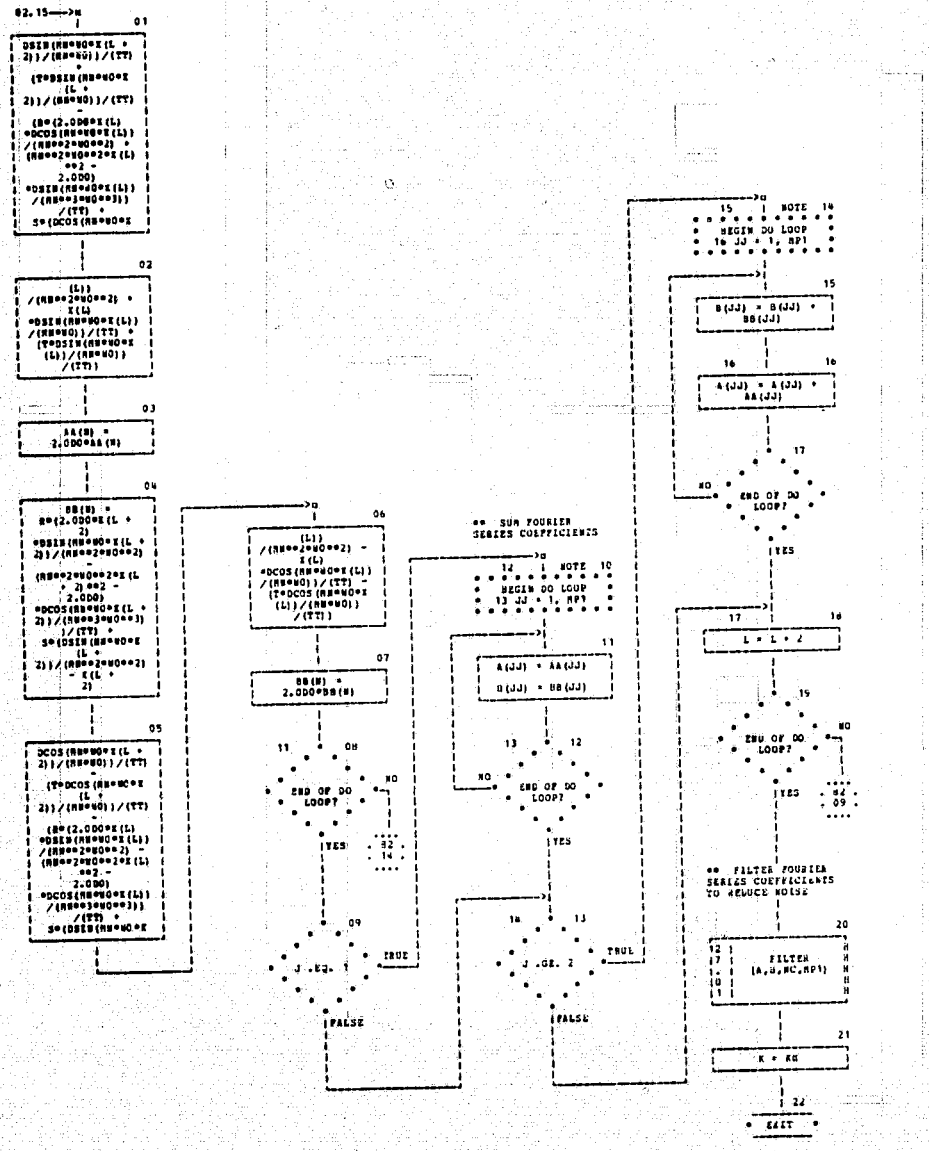
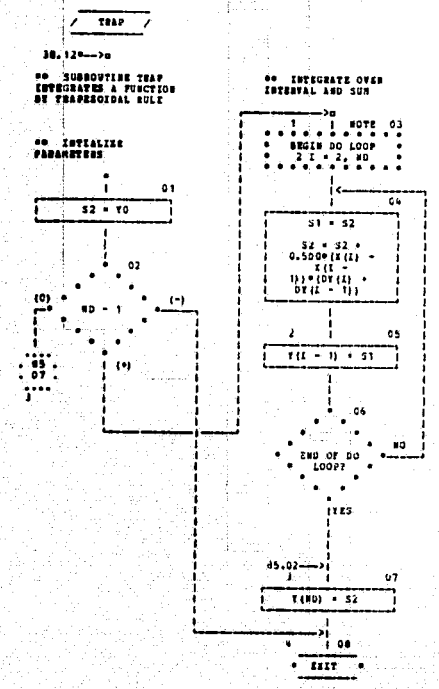


CHART TITLE - SUBROUTINE TRAP(ND,X,DY,Y,YO)



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CHART TITLE - SUBROUTINE PRE(X,P,Y,PP,PPP,SS,SS,SI)

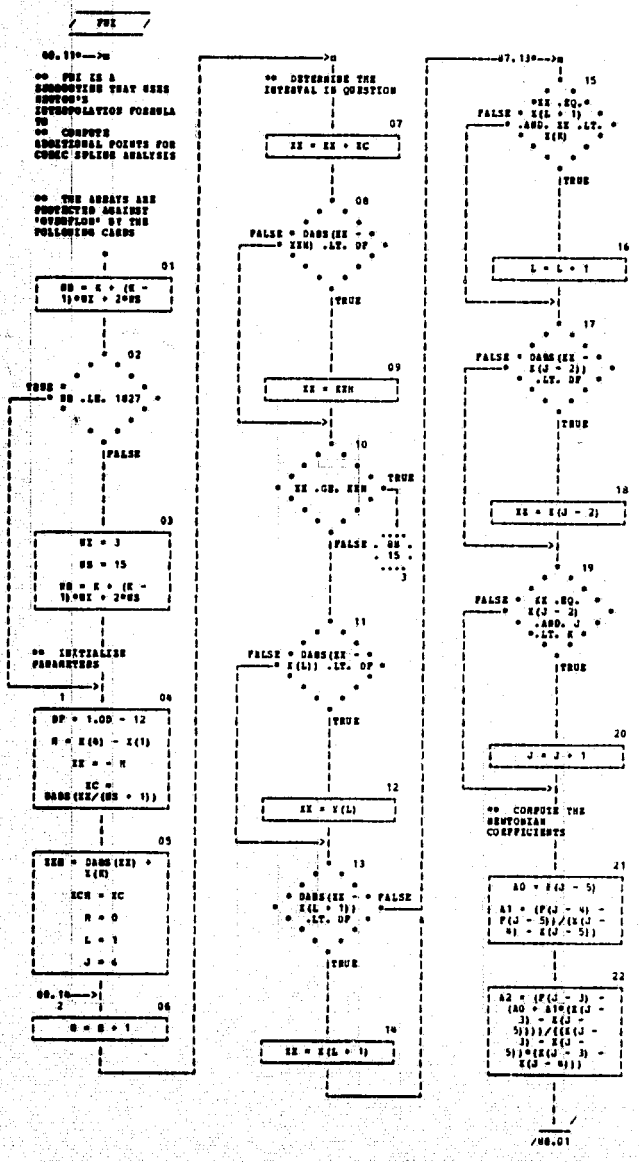
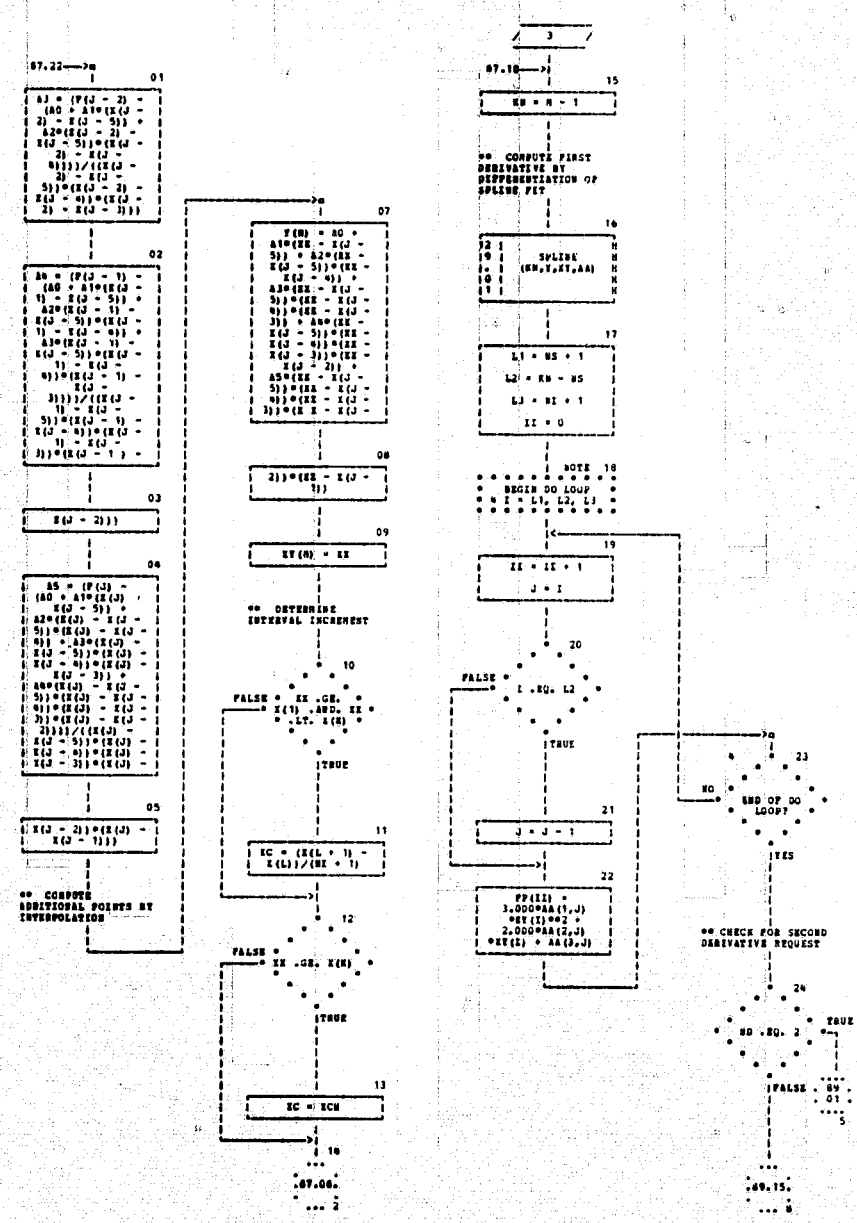


CHART TITLE - SUBROUTINE FDB(N,P,X,FP,FPP,ND,NS,NI)



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CHART TITLE - SUBROUTINE FDS(N,F,X,FD,FDD,BB,BE,BI)

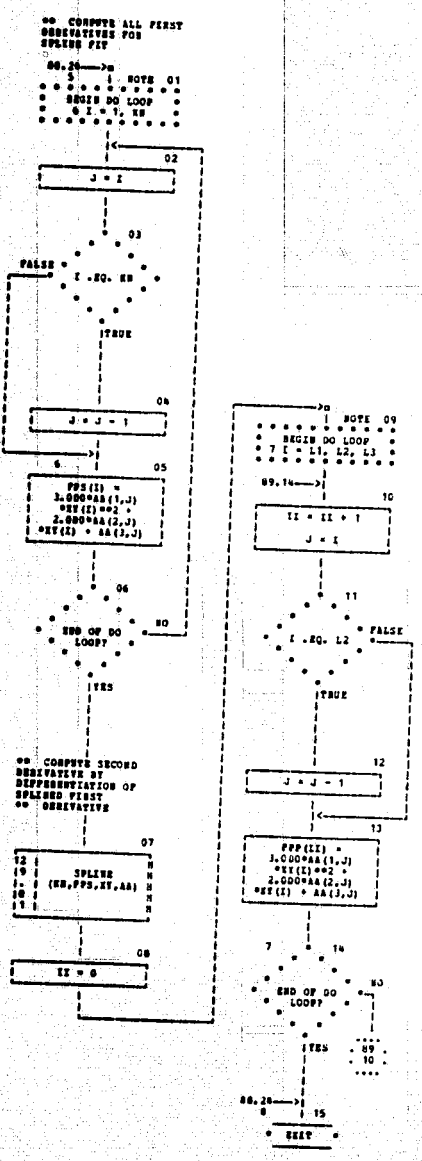
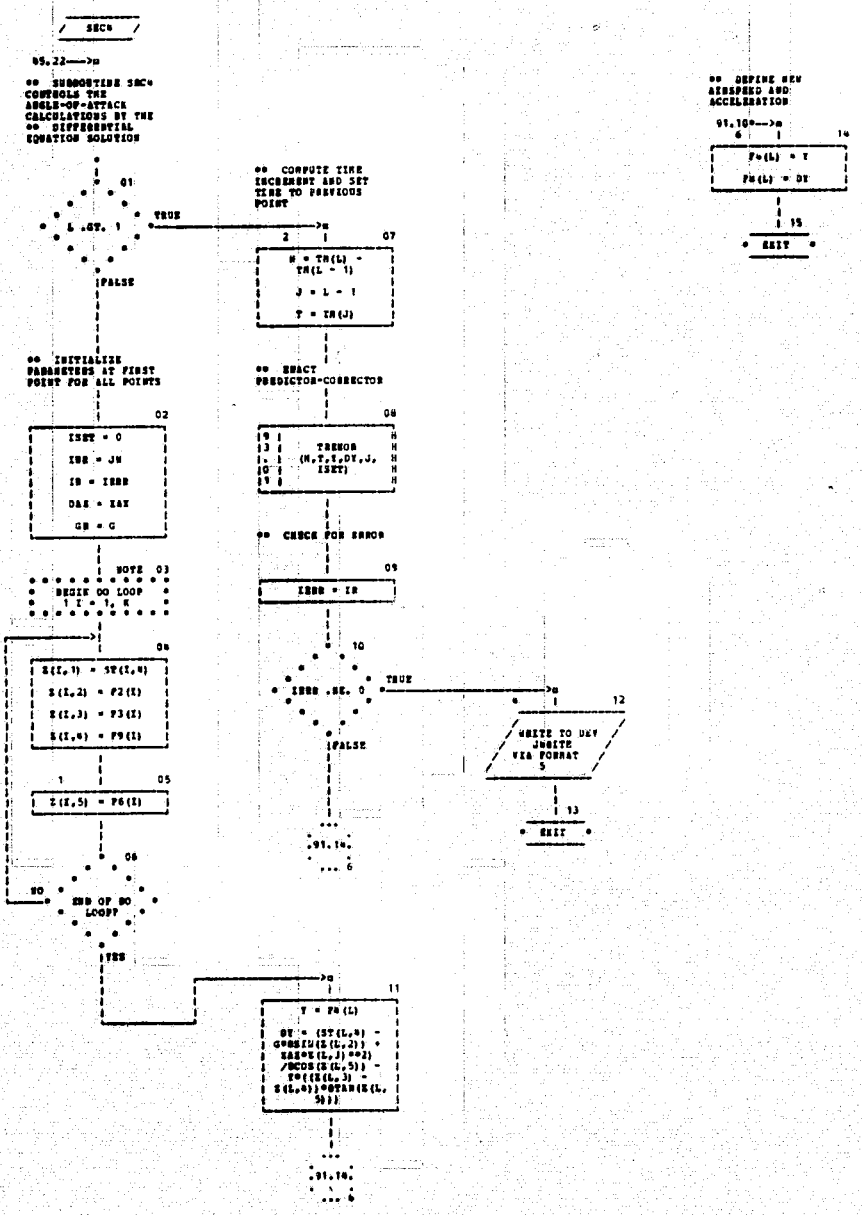


CHART TITLE - SUBROUTINE SEC*(L,E,ESE)



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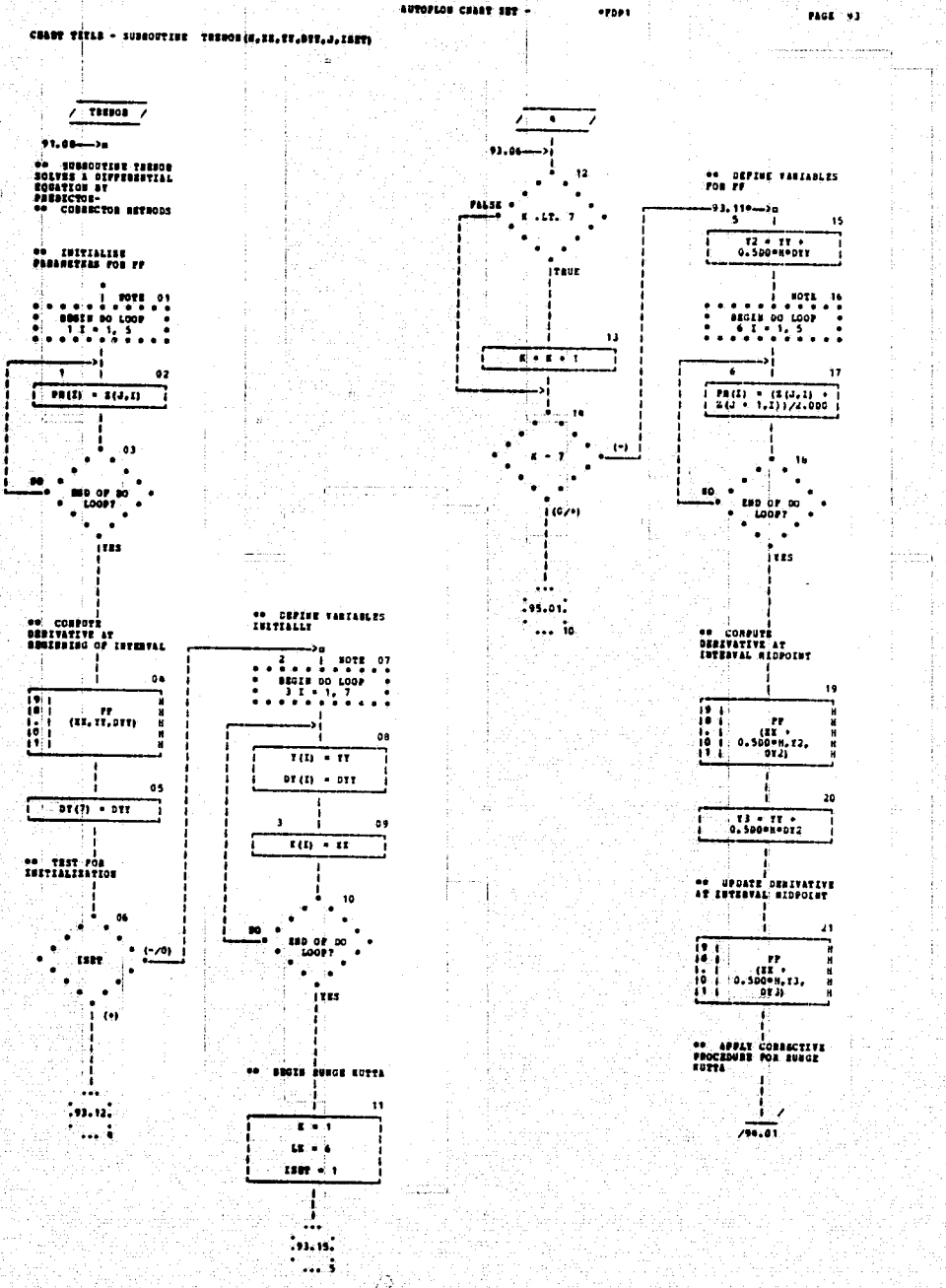
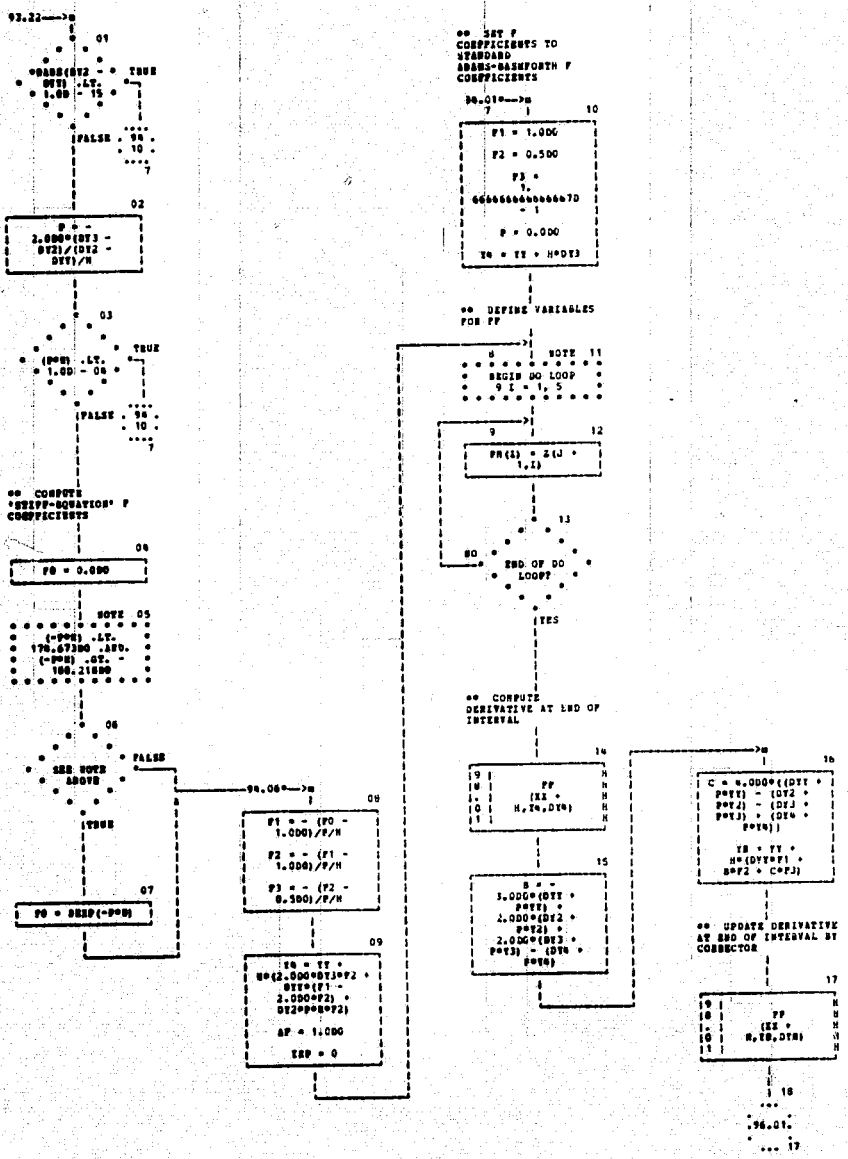


CHART TITLE - SUBROUTINE TREMOR(N,XX,YY,DIF,J,ISET)



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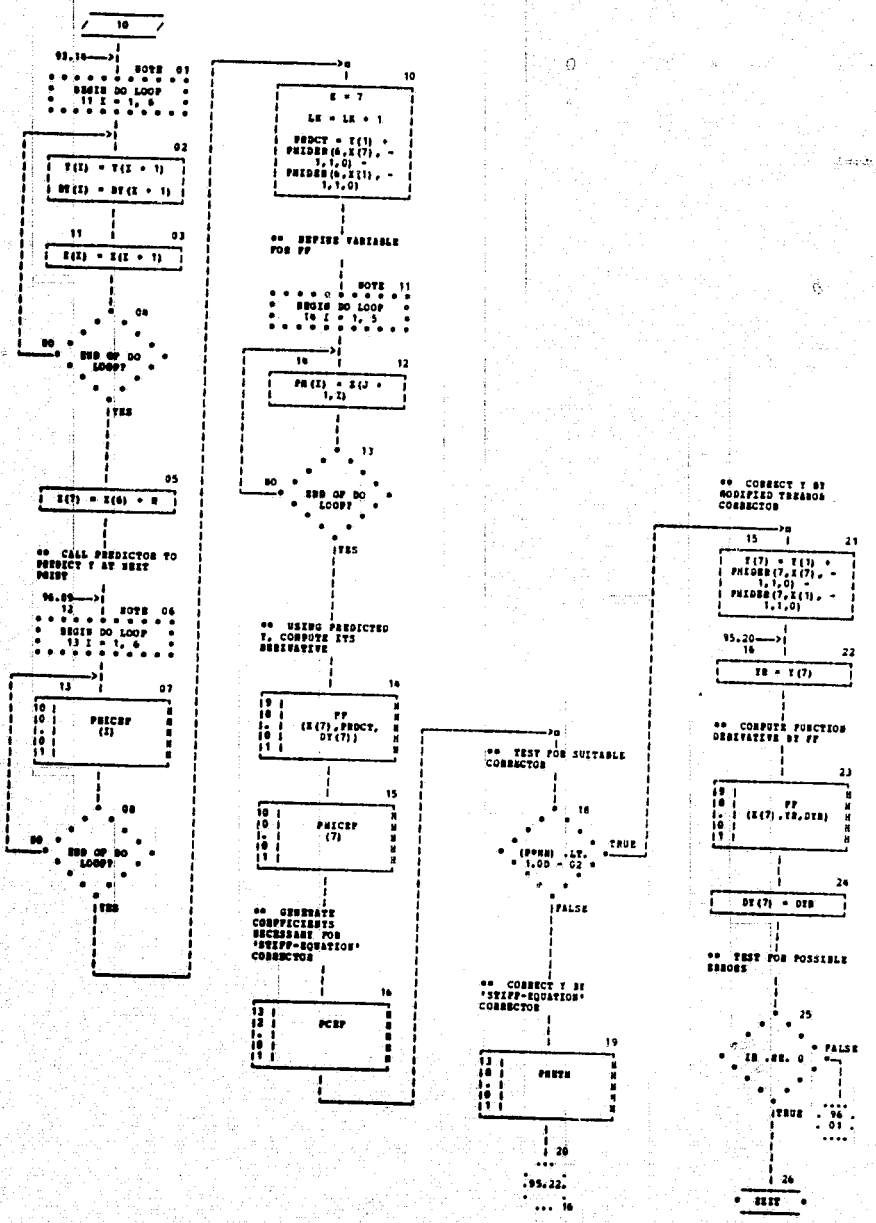
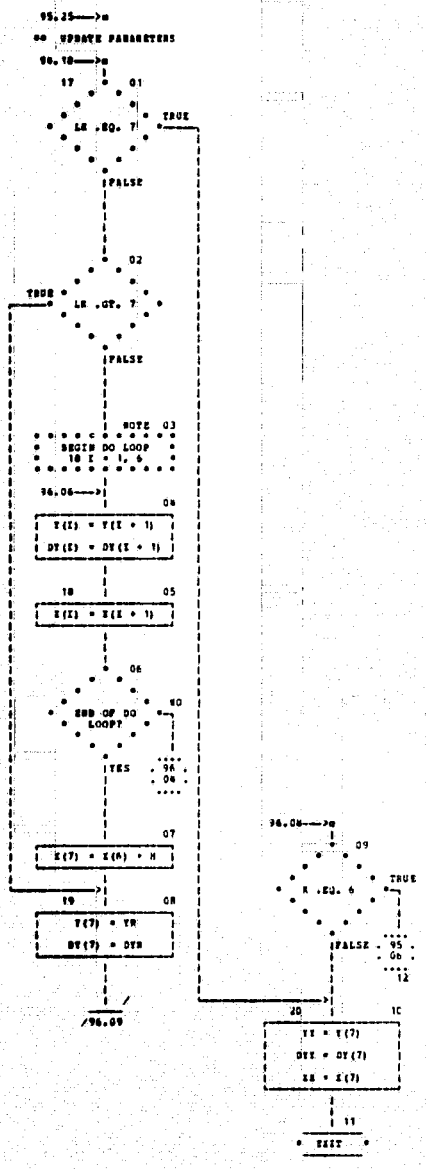


CHART TITLE - SUBROUTINE THERMOB(N,EE,YY,DYY,J,ISET)



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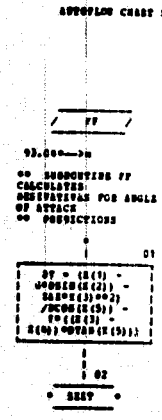
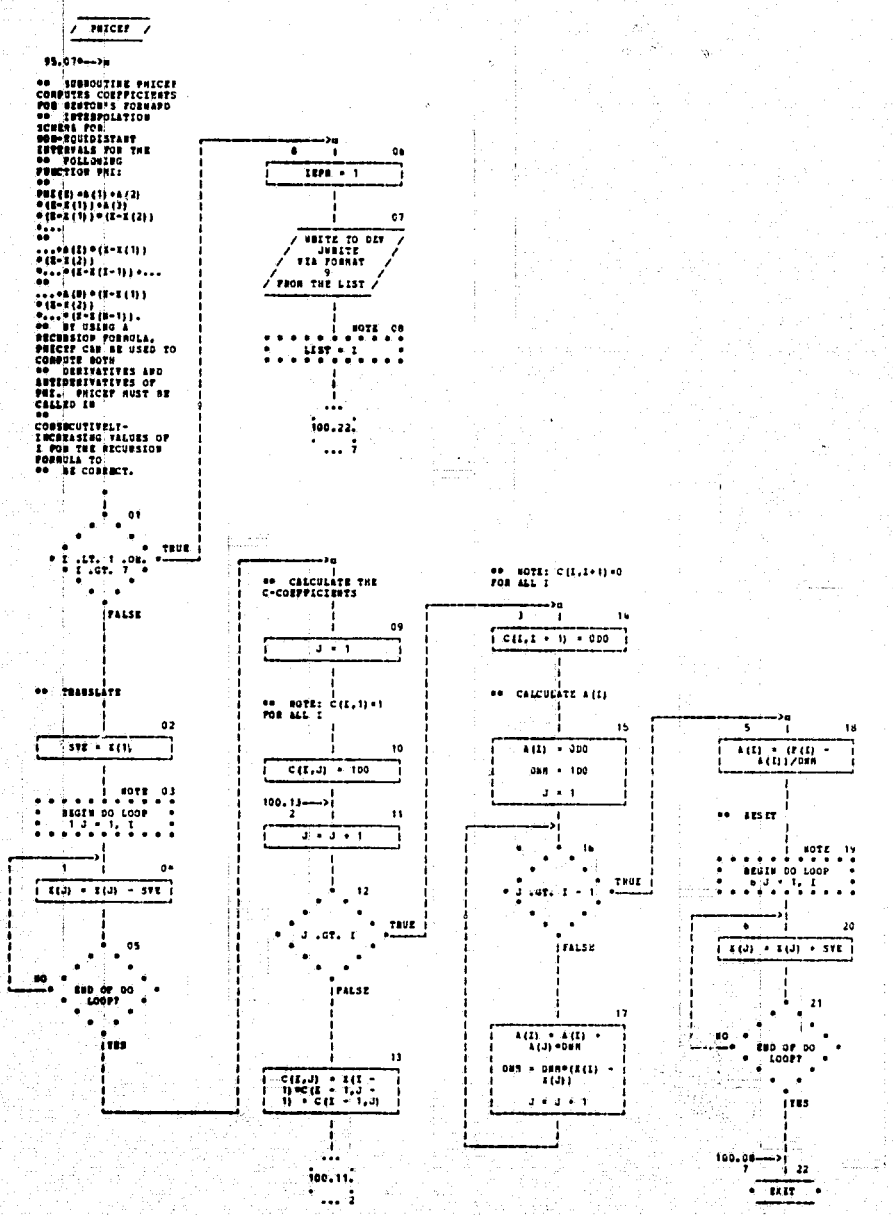


CHART TITLE - SUBROUTINE PHICEF(I)



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CHART TITLE - SUBROUTINE LLSQAR(A,B,N,NA,NB,IA,IB,IDGT,WRAREA,IER,JWRITE)

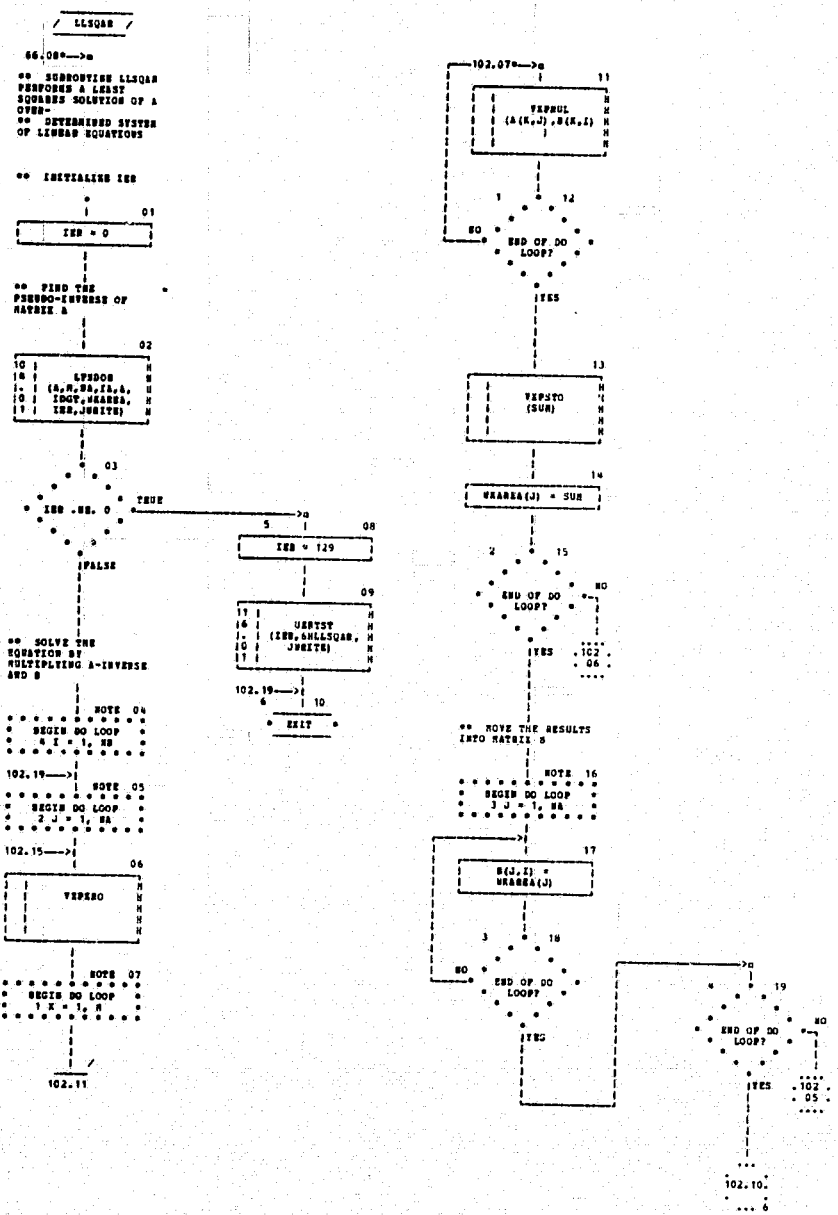
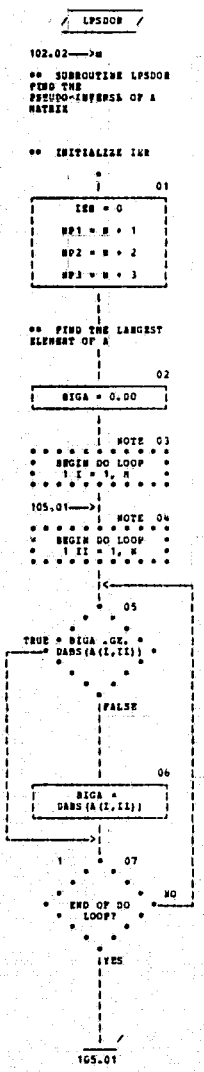


CHART TITLE - SUBROUTINE LPSDOR(A,M,N,IA,AINV,IOGT,WKAREA,IER,JWRITE)



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CHART TITLE - SUBROUTINE LPSDOR(A,M,N,IA,AINV,IDGT,WKAREA,IER,JUNIT)

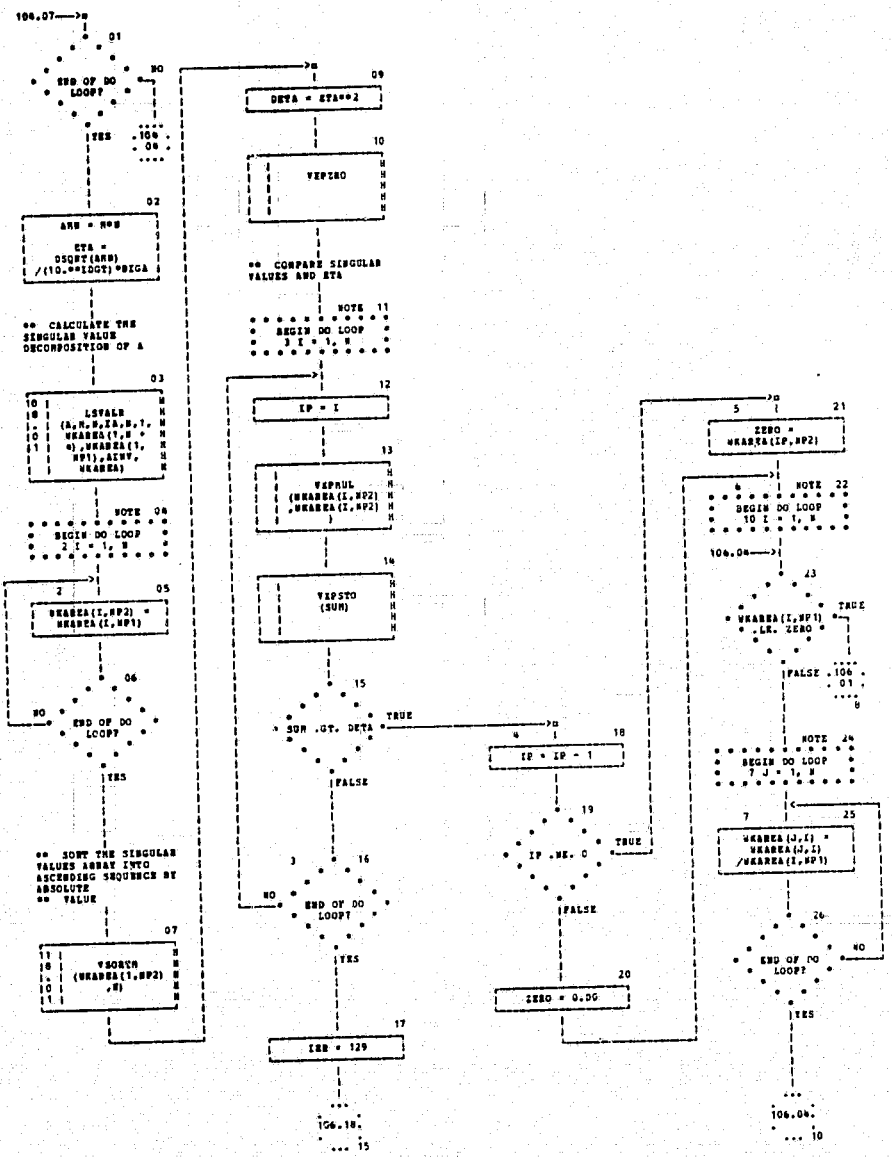
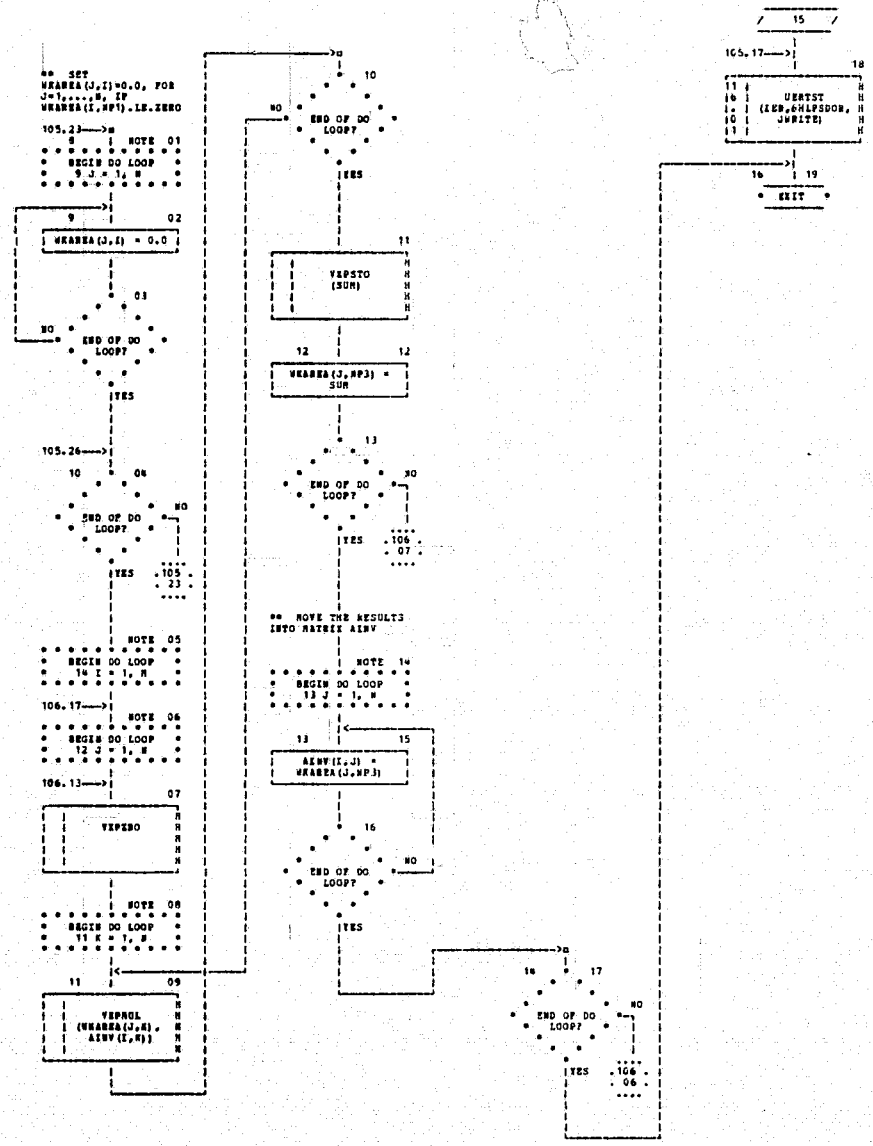


CHART TITLE - SUBROUTINE LPSDOR(A,M,N,IA,AINV,IUGT,WKAREA,IER,JWRITE)



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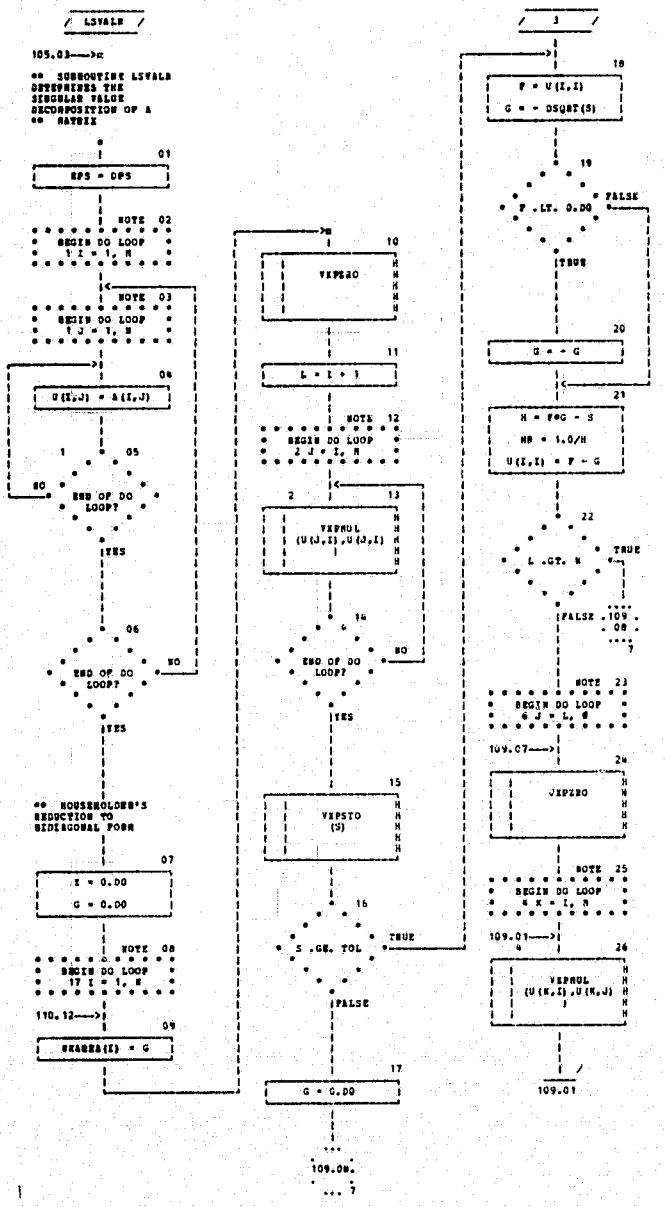
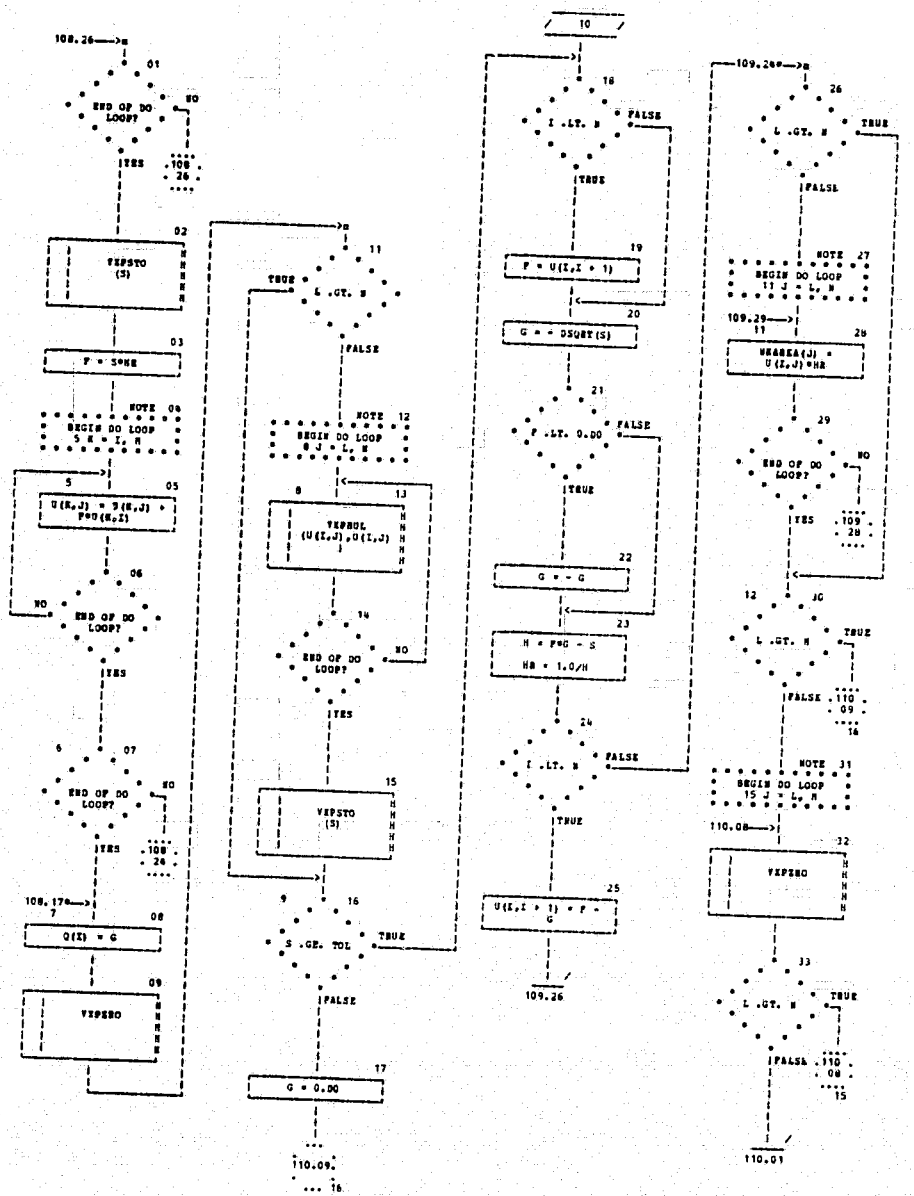


CHART TITLE - SUBROUTINE LSVALS(A,N,B,IA,EV,ISW,WEAREA,Q,U,V)



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CHART TITLE - SUBROUTINE LSVALR(A,N,B,IA,IV,ISW,WEABEA,Q,B,V)

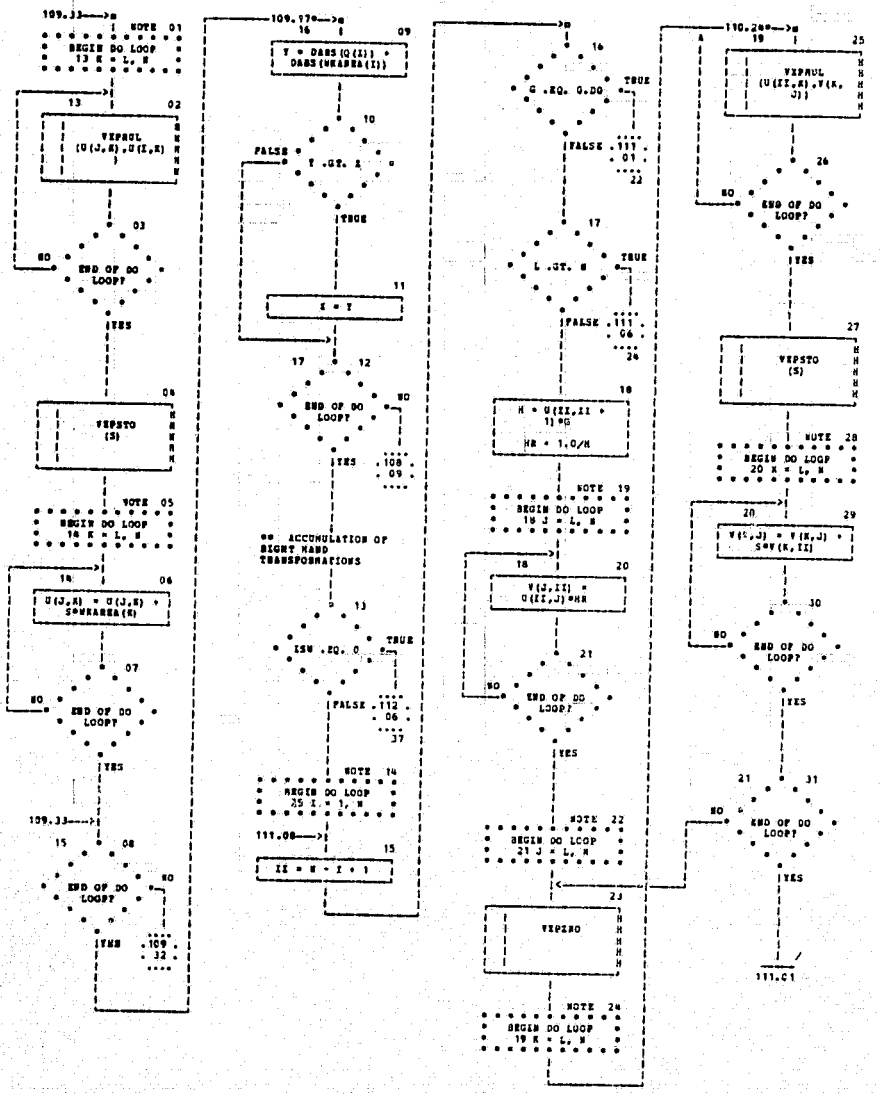
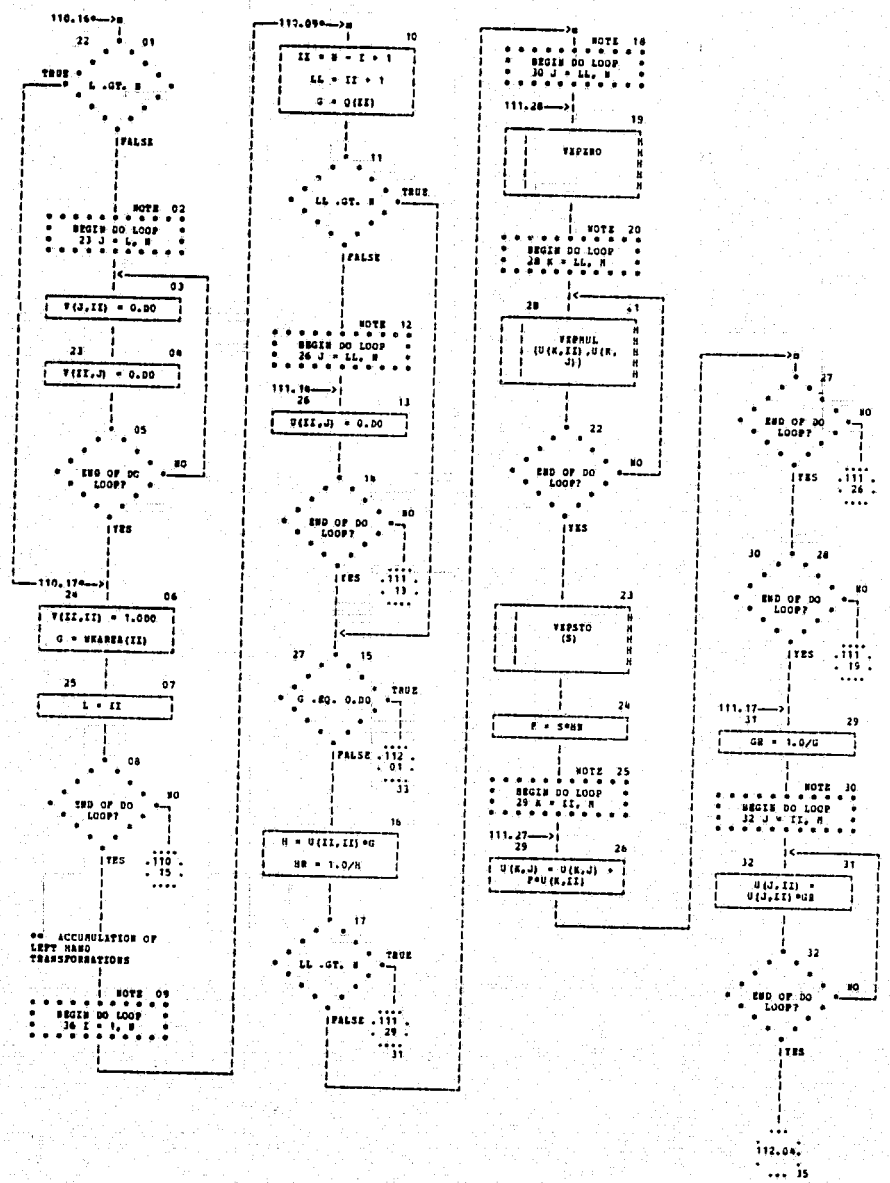


CHART TITLE - SUBROUTINE LEVALS(A,M,N,IA,IV,ISW,WAREA,Q,U,V)



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CHART TITLE - SUBROUTINE LSFALB(A,B,N,IA,IV,ISW,WKAREA,Q,U,V)

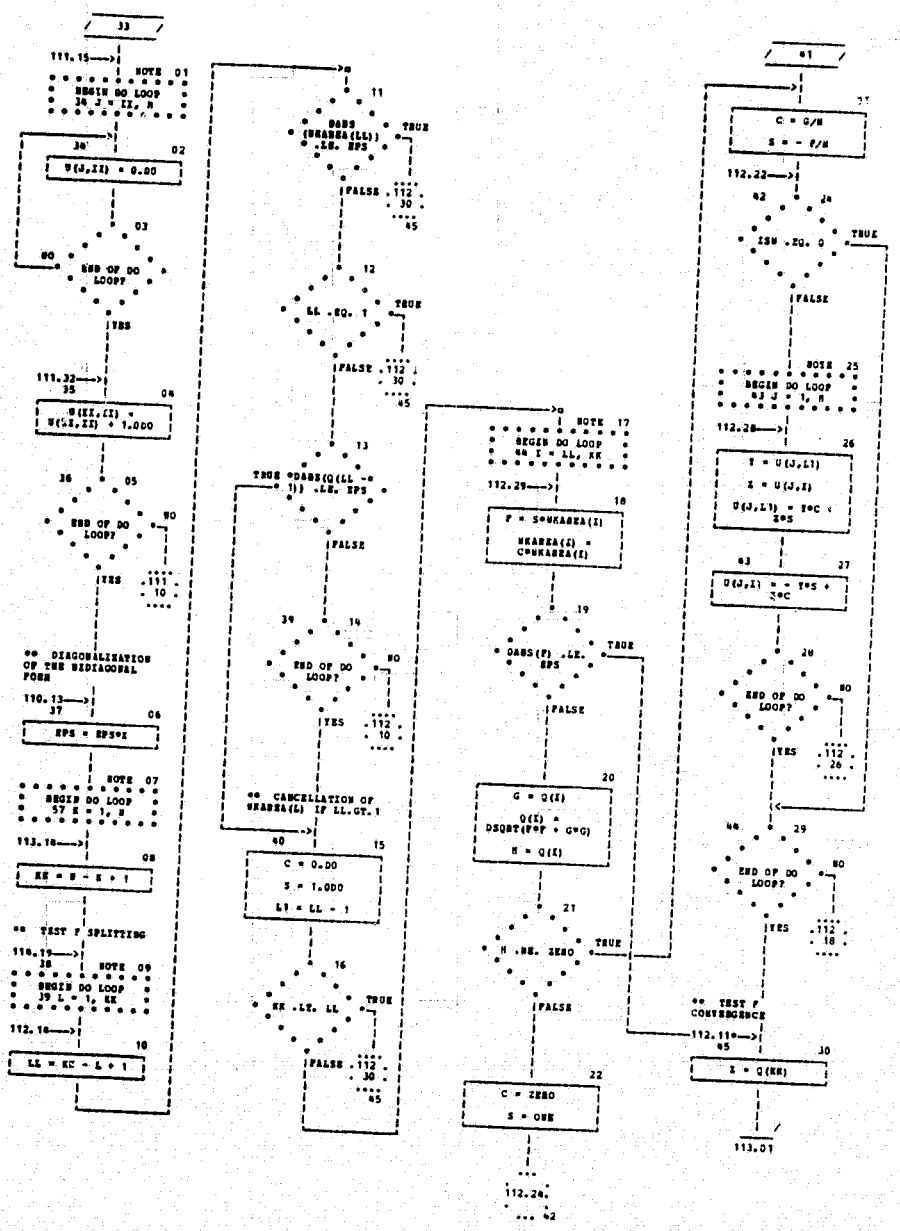
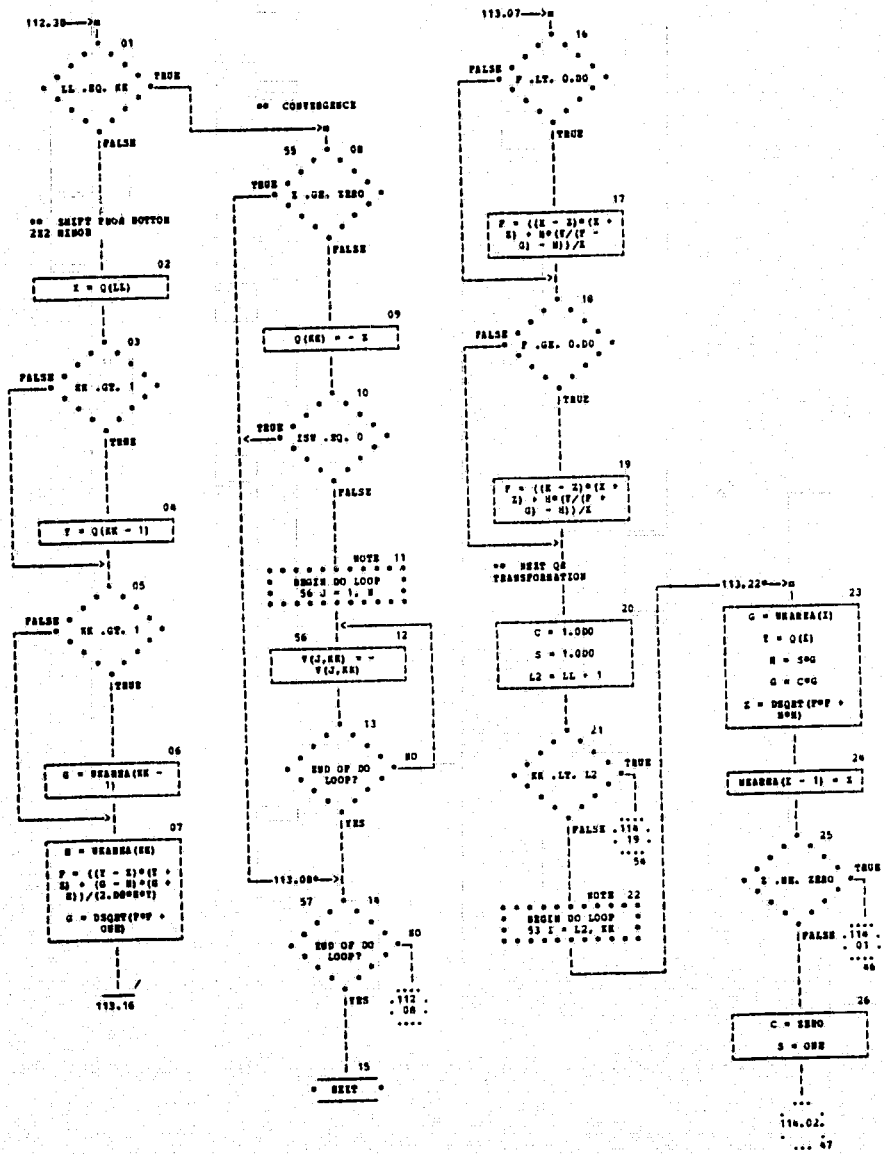


CHART TITLE - SUBROUTINE LEVALS(A,B,N,IA,IV,ISW,NEARBA,Q,U,V)



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CHART TITLE - SUBROUTINE LEVALS(A,B,N,IA,IV,ISW,WEABSA,Q,U,V)

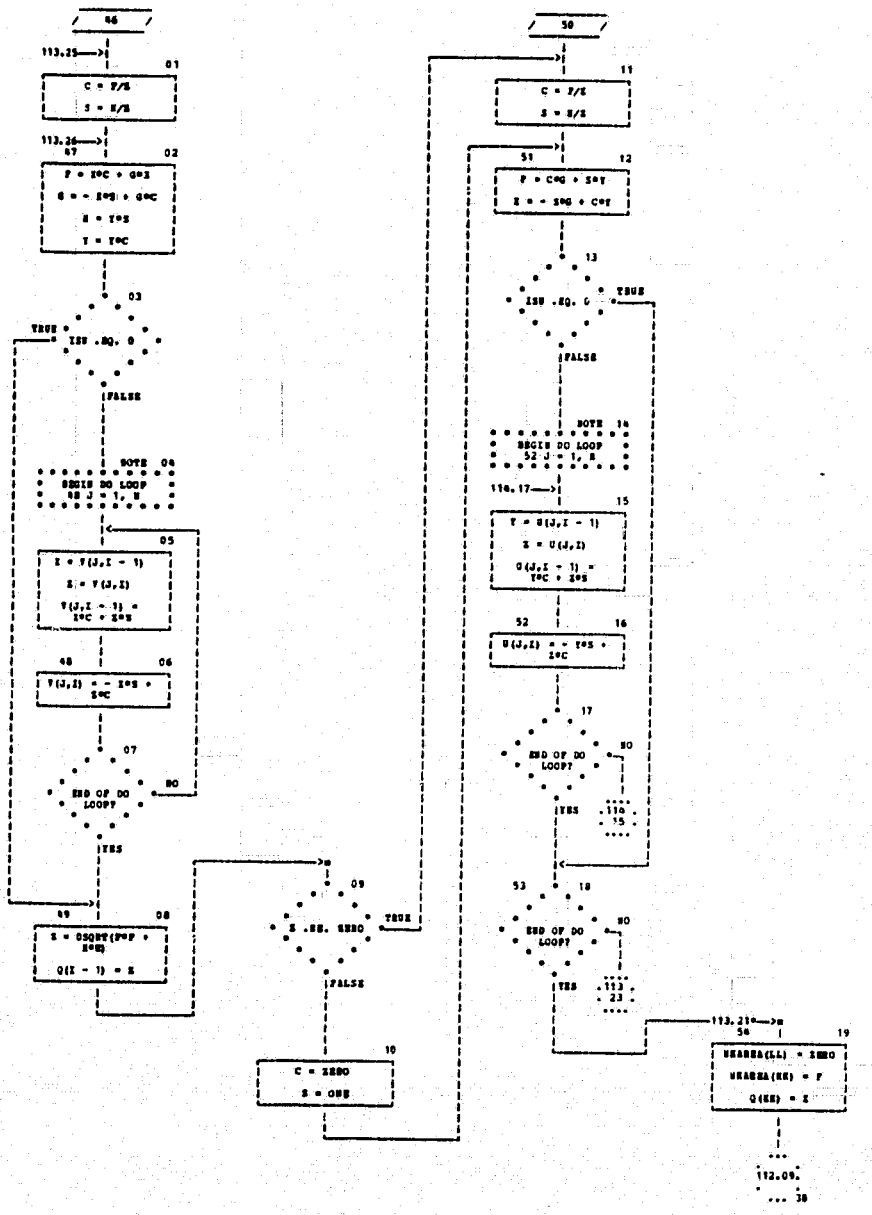
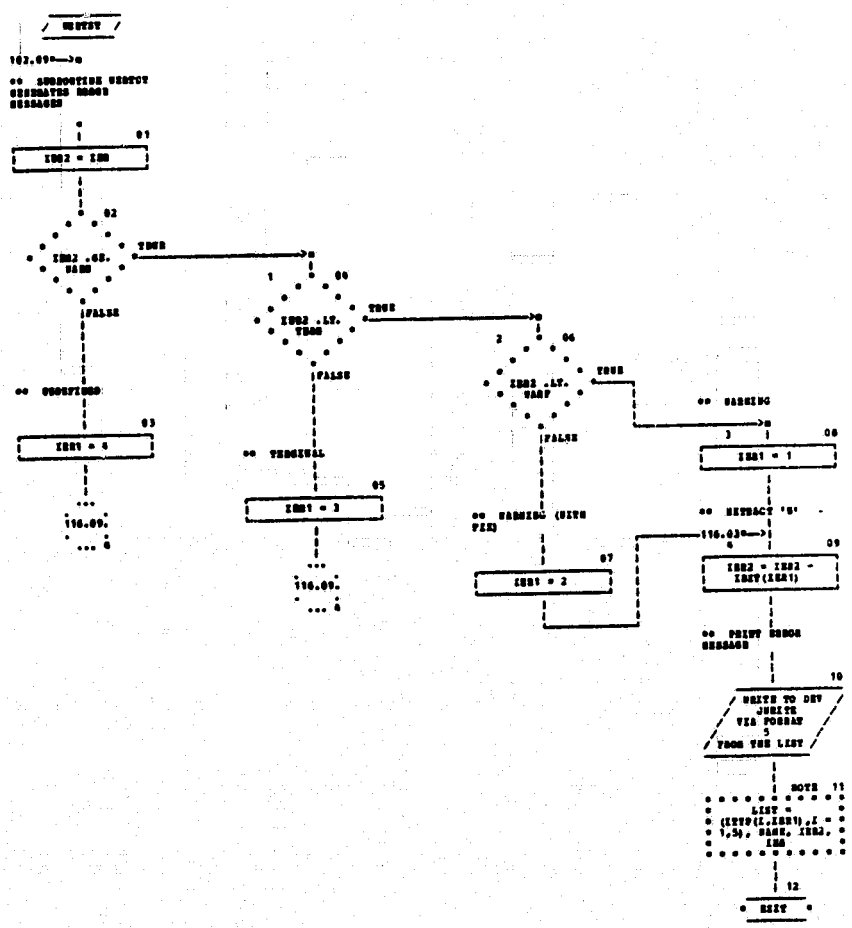


CHART TITLE - SUBROUTINE ERRCHT(IER,NAME,JOBITR)



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CHART TITLE - SUBROUTINE YSORTA(A,LA)

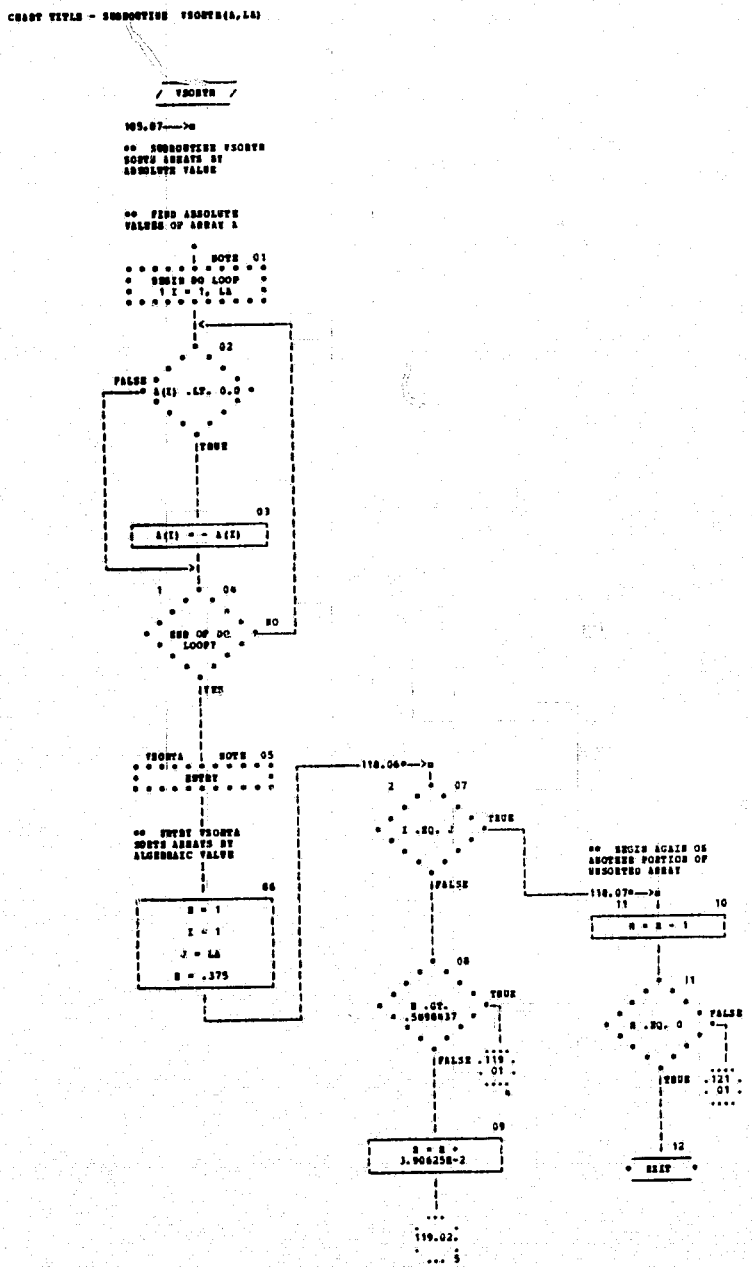


CHART TITLE - SUBROUTINE *SORTR(A,LA)

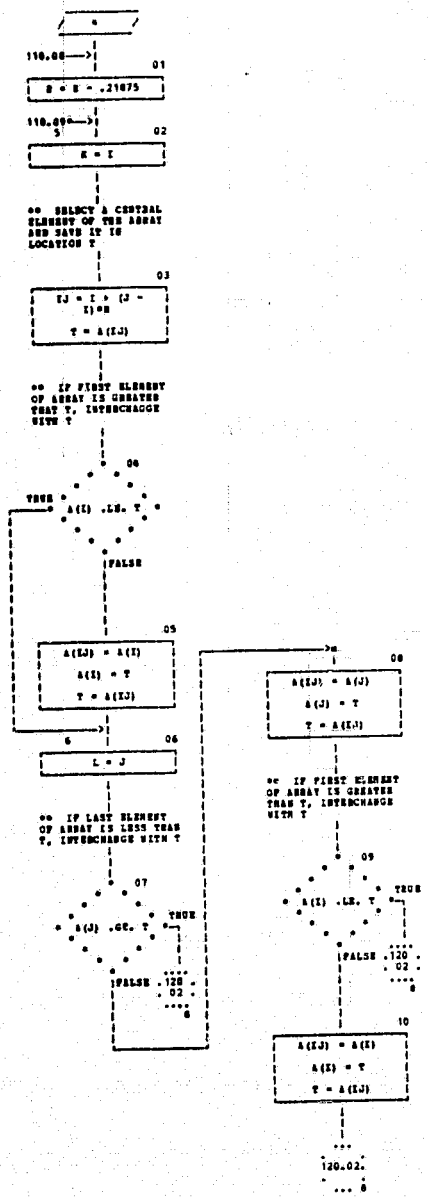
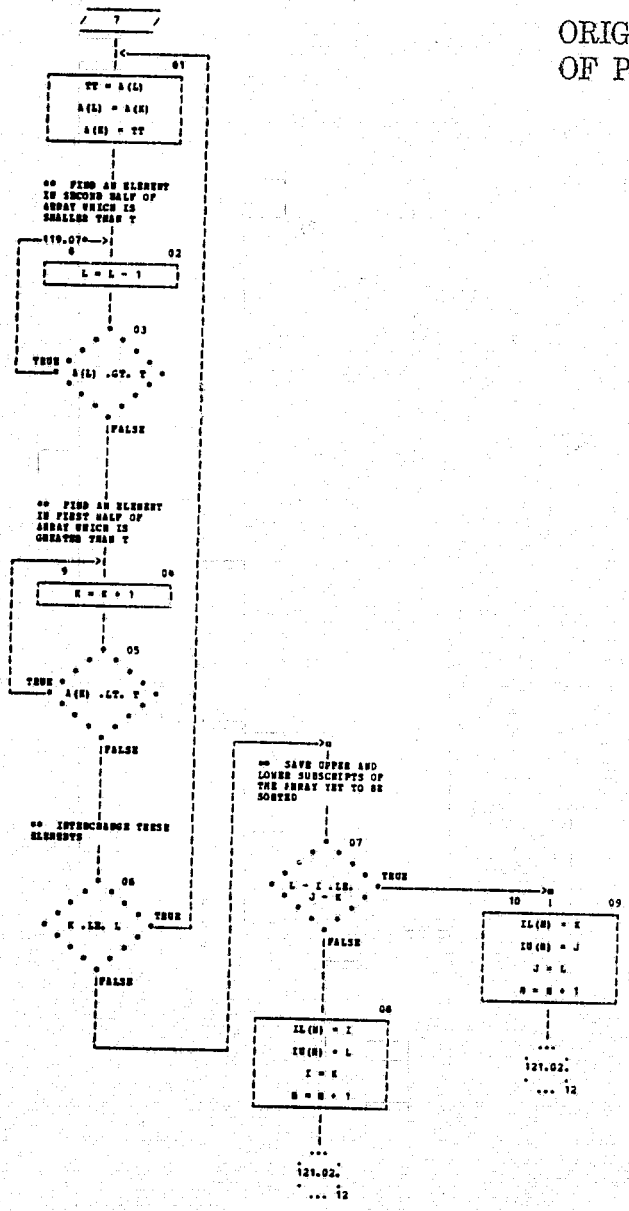
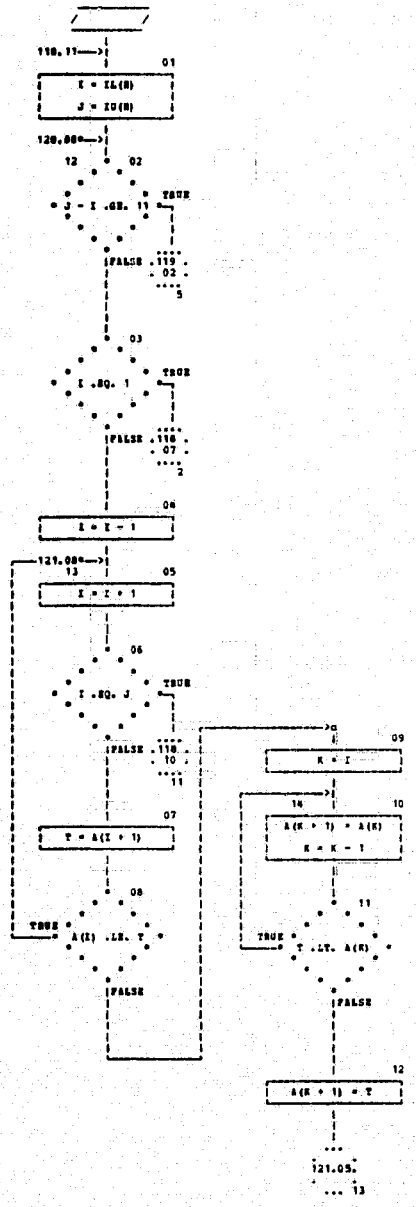


CHART TITLE - SUBROUTINE QSORTS(A,LA)



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OF POOR QUALITY

CHART TITLE = SUBROUTINE ISORT(A,LA)



ORIGINAL PAGE IS
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CHART TITLE - SUBROUTINE HADD(A,B,N,R,RS)

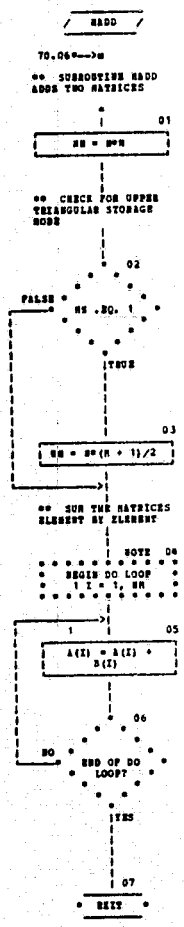
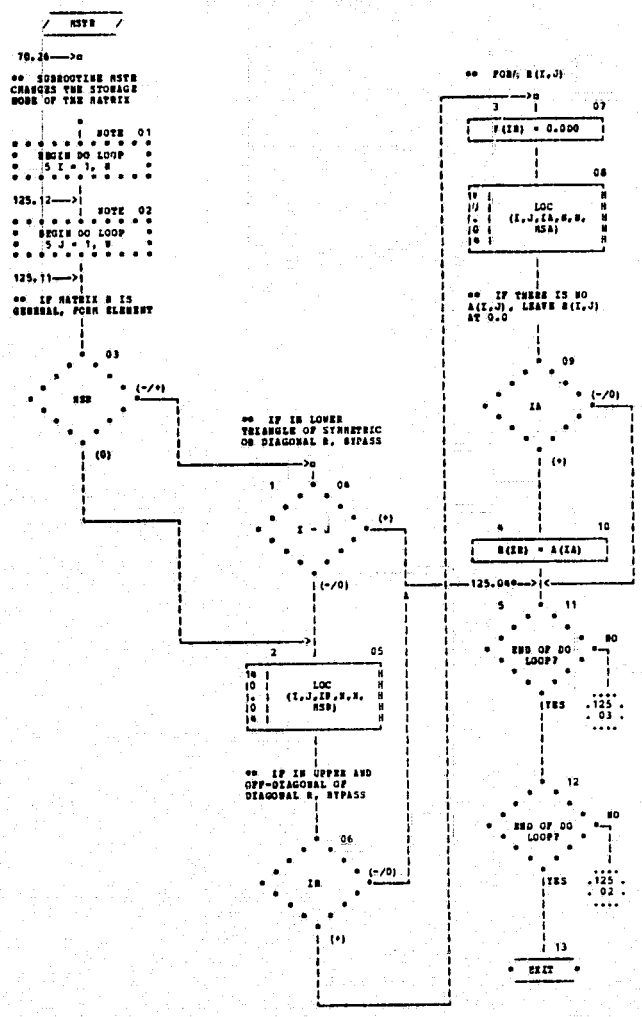


CHART TITLE - SUBROUTINE RSTR(A,B,N,NSA,NSB)



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CHART TITLE - SUBROUTINE FILTER(A,B,NCUT,NPT)

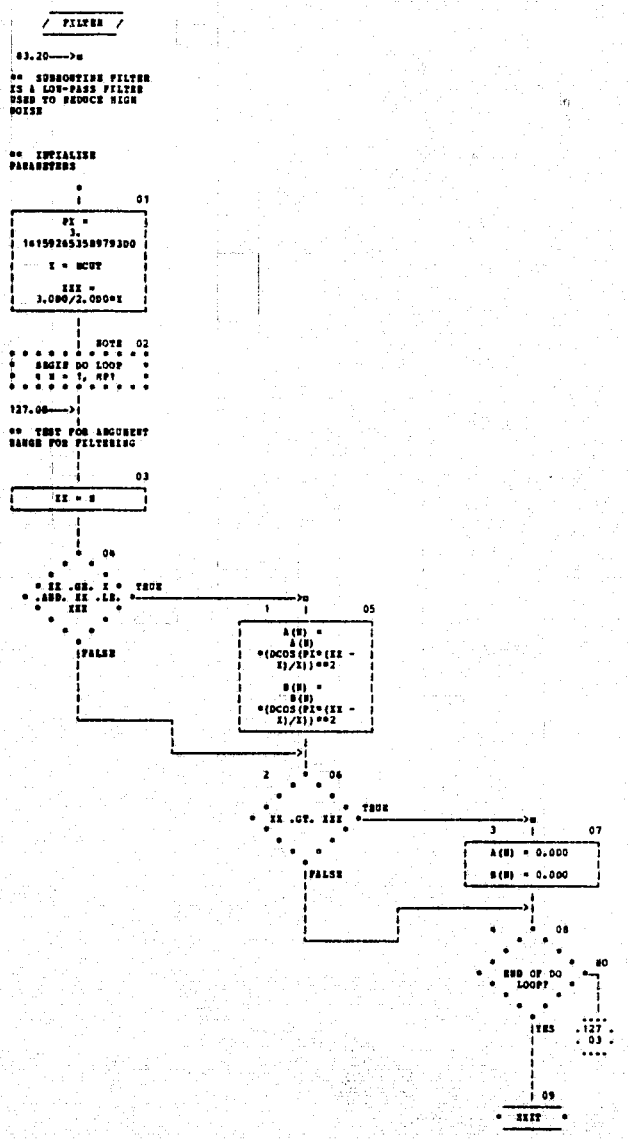
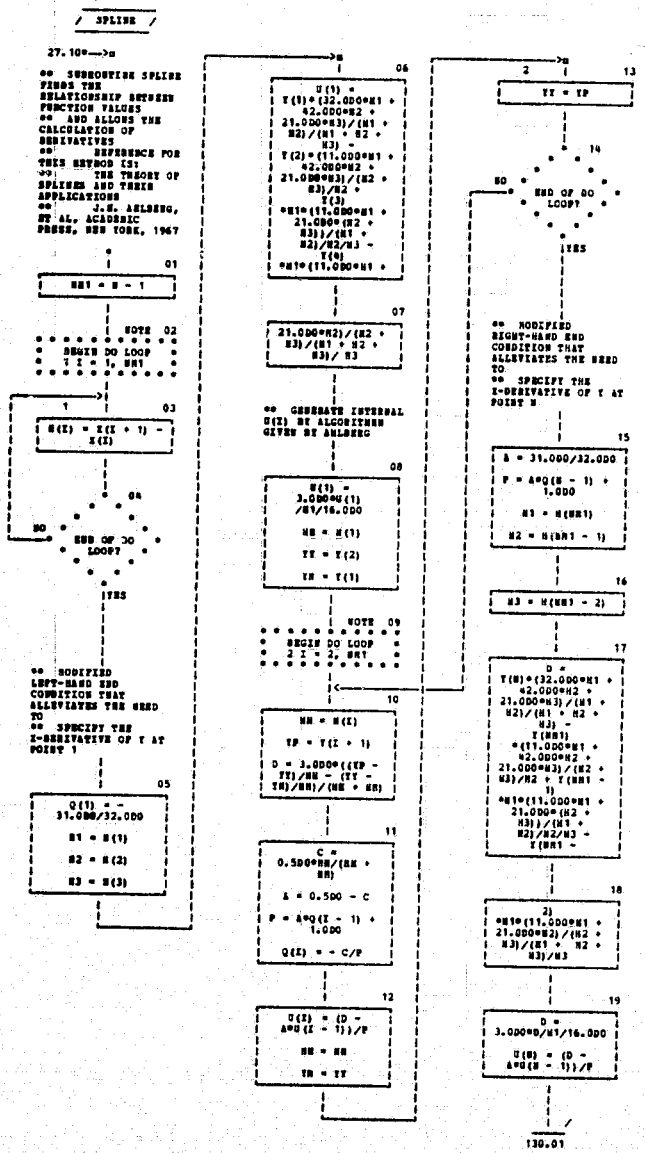
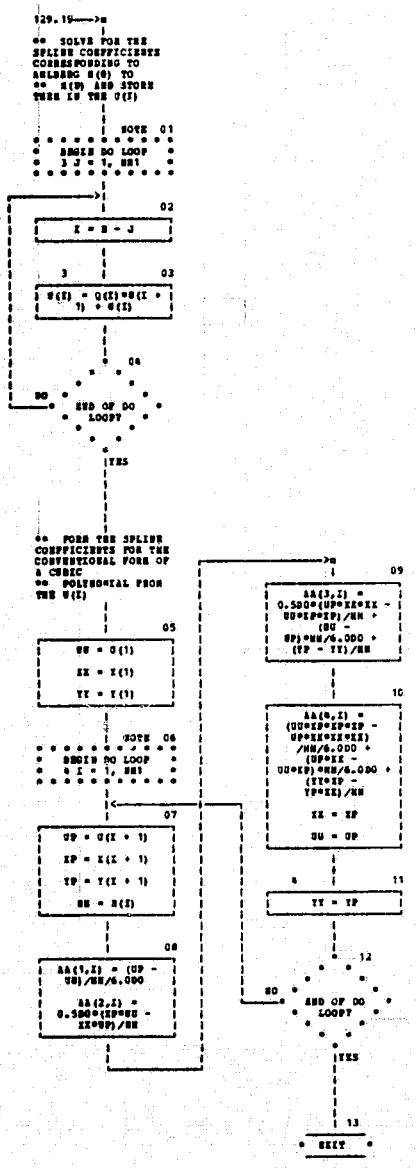


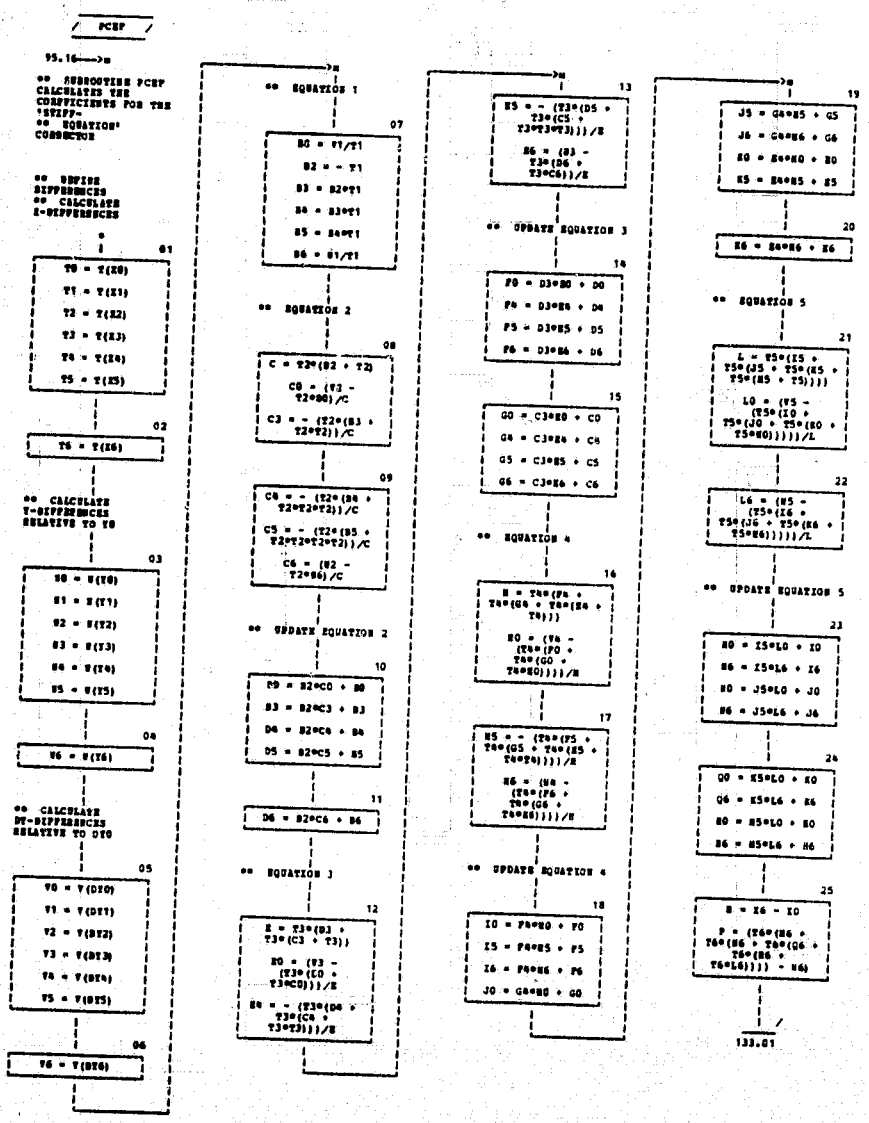
CHART TITLE - SUBROUTINE SPLINE(N,X,Y,A,B)



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CHART TITLE - SUBROUTINE SPLINE(N,T,X,AA)




PCEF
95.16
** SUBROUTINE PCEF CALCULATES THE COEFFICIENTS FOR THE 'STIFF-** EQUATION' CORRECTOR
** DEFINE DIFFERENCES
** CALCULATE Z-DIFFERENCES
01
T0 = Y(I0)
T1 = Y(I1)
T2 = Y(I2)
T3 = Y(I3)
T4 = Y(I4)
T5 = Y(I5)
02
T6 = Y(I6)
** CALCULATE Y-DIFFERENCES RELATIVE TO T0
03
S0 = S(T0)
S1 = S(T1)
S2 = S(T2)
S3 = S(T3)
S4 = S(T4)
S5 = S(T5)
04
S6 = S(T6)
** CALCULATE DY-DIFFERENCES RELATIVE TO DT0
05
V0 = Y(DT0)
V1 = Y(DT1)
V2 = Y(DT2)
V3 = Y(DT3)
V4 = Y(DT4)
V5 = Y(DT5)
06
V6 = Y(DT6)
** EQUATION 1
07
B0 = T1/T1
B2 = - T1
B3 = B2*T1
B4 = B3*T1
B5 = B4*T1
B6 = B1/T1
** EQUATION 2
08
C = T2*(B2 + T2)
C0 = (T1 - T2*B0)/C
C3 = - (T2*(B3 + T2*T2))/C
09
C6 = - (T2*(B6 + T2*T2*T2))/C
C5 = - (T2*(B5 + T2*T2*T2*T2))/C
C6 = (B2 - T2*B6)/C
** UPDATE EQUATION 2
10
D0 = B2*C0 + B0
D3 = B2*C3 + B3
D4 = B2*C4 + B4
D5 = B2*C5 + B5
11
D6 = B2*C6 + B6
** EQUATION 3
12
E = T3*(B3 + T3*(C3 + T3))
E0 = (Y3 - (T3*(C0 + T3*C0)))/E
E4 = - (T3*(D4 + T3*(C4 + T3*T3)))/E
13
E5 = - (T3*(D5 + T3*(C5 + T3*T3*T3)))/E
E6 = (B3 - T3*(D6 + T3*C6))/E
** UPDATE EQUATION 3
14
F0 = D3*E0 + D0
F4 = D3*E4 + D4
F5 = D3*E5 + D5
F6 = D3*E6 + D6
15
G0 = C3*E0 + C0
G4 = C3*E4 + C4
G5 = C3*E5 + C5
G6 = C3*E6 + C6
** EQUATION 4
16
H = T4*(F4 + T4*(G4 + T4*(E4 + T4*T4)))
H0 = (Y4 - (T4*(F0 + T4*(G0 + T4*(E0 + T4*H0)))))/H
17
H5 = - (T4*(F5 + T4*(G5 + T4*(E5 + T4*T4*T4))))/H
H6 = (H4 - (T4*(F6 + T4*(G6 + T4*E6))))/H
** UPDATE EQUATION 4
18
I0 = F4*E0 + F0
I5 = F4*E5 + F5
I6 = F4*E6 + F6
J0 = G4*E0 + G0
19
J5 = G4*E5 + G5
J6 = G4*E6 + G6
K0 = E4*E0 + E0
K5 = E4*E5 + E5
20
K6 = E4*E6 + E6
** EQUATION 5
21
L = T5*(I5 + T5*(J5 + T5*(K5 + T5*(K5 + T5*T5))))
L0 = (Y5 - (T5*(I0 + T5*(J0 + T5*(K0 + T5*K0)))))/L
22
L6 = (H5 - (T5*(I6 + T5*(J6 + T5*(K6 + T5*K6)))))/L
** UPDATE EQUATION 5
23
M0 = I5*L0 + I0
M6 = I5*L6 + I6
N0 = J5*L0 + J0
N6 = J5*L6 + J6
24
O0 = K5*L0 + K0
O6 = K5*L6 + K6
P0 = E5*L0 + E0
P6 = E5*L6 + K6
25
S = I6 - I0
P = (T6*(H6 + T6*(M6 + T6*(O6 + T6*(P6 + T6*L6)))) - N6)
133.01

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CHART TITLE - SUBROUTINE PCEP

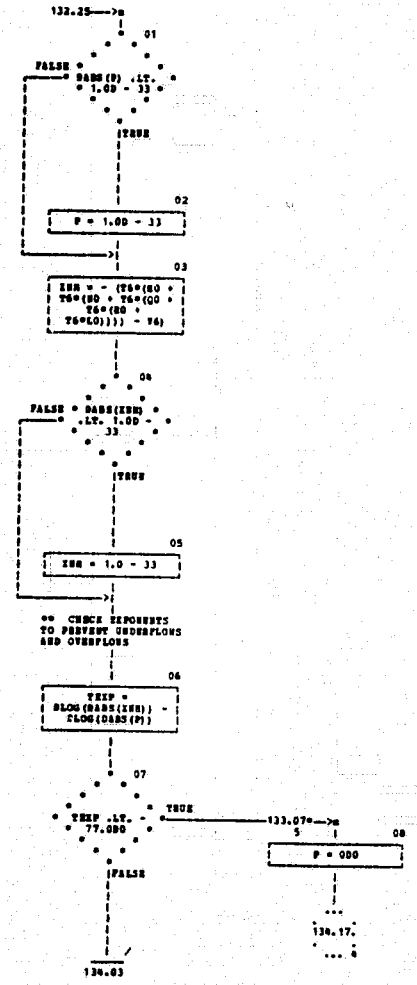
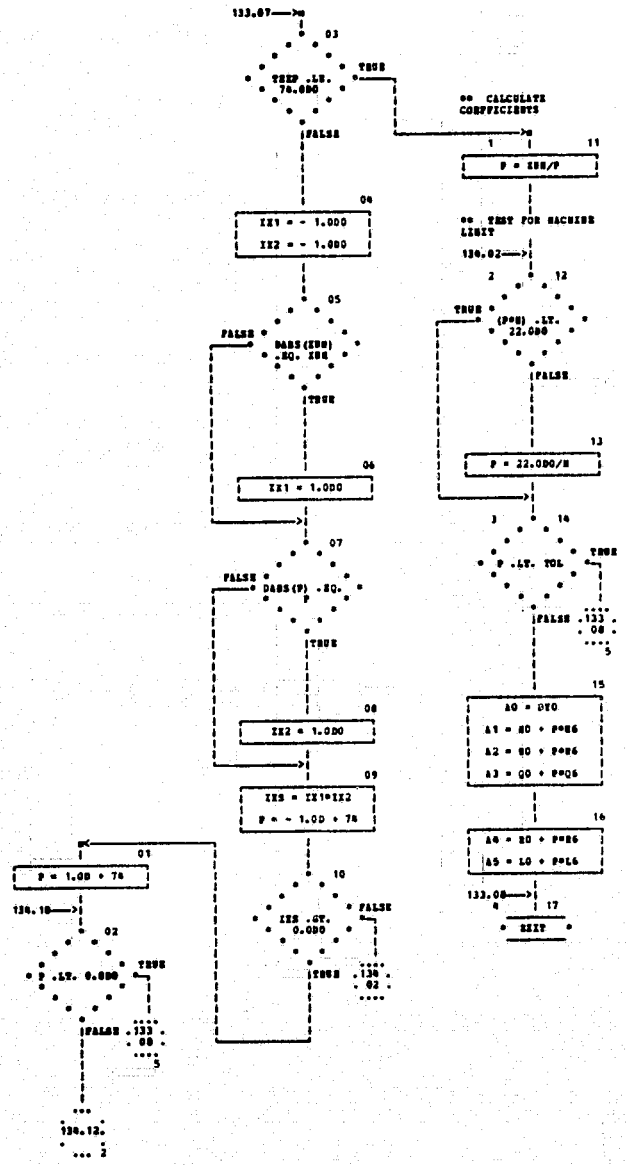
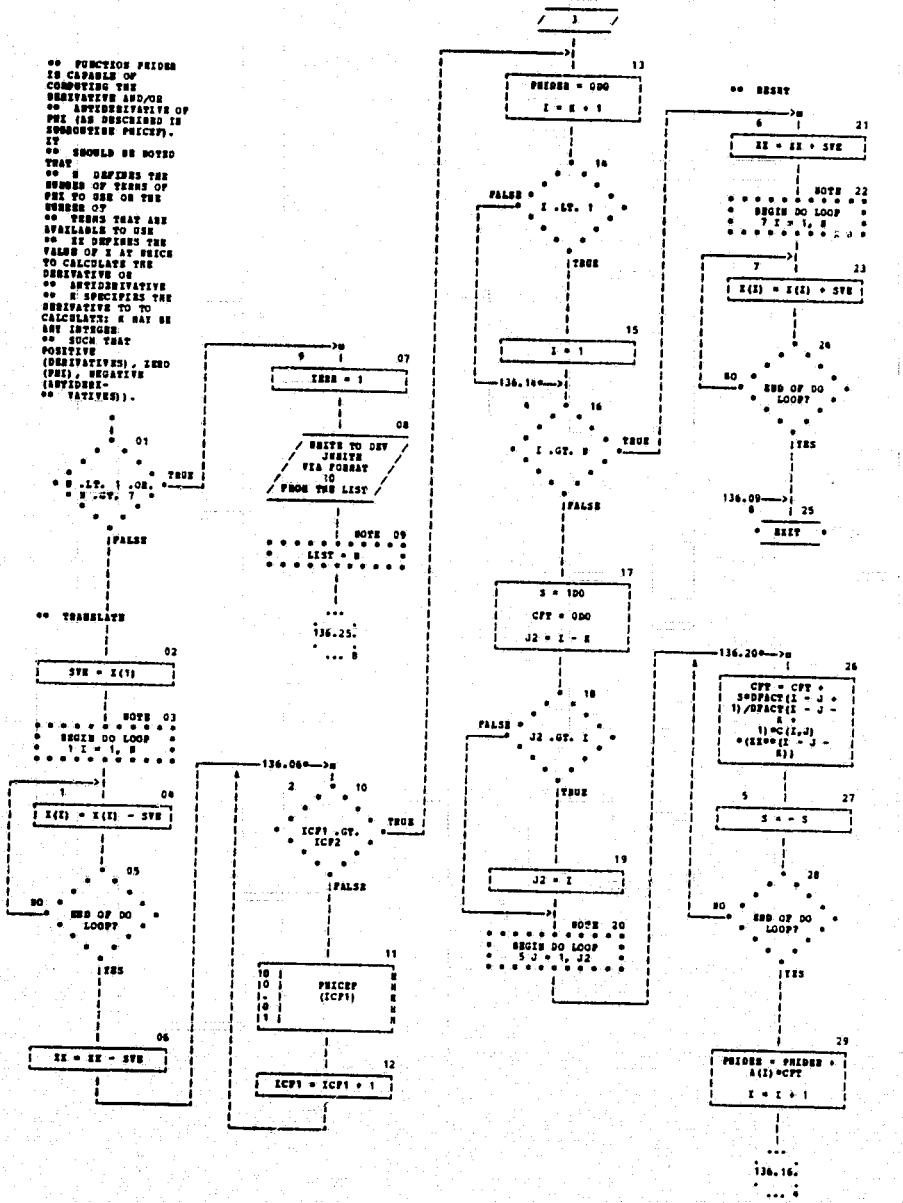


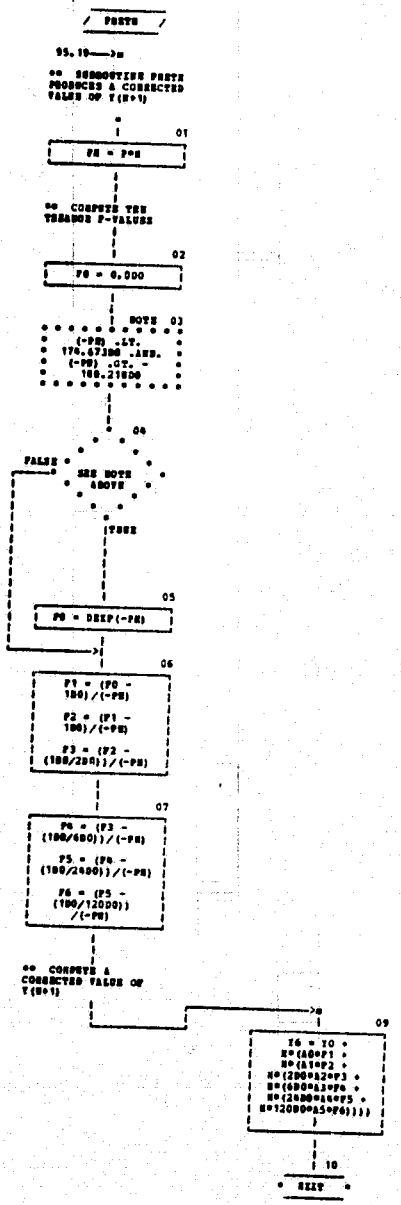
CHART TITLE - SUBROUTINE PCAP



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CHART TITLE - FUNCTION PHIDER(N,XX,K,ICP1,ICP2)




PRETH
95.10
** SUBROUTINE PRETH PRODUCES A CORRECTED VALUE OF T(N+1)
01
PH = P*H
** COMPUTE TEN TERMINAL P-VALUES
02
P0 = 0.000
NOTE 03
(-PH) .LT. 174.67388 .AND. (-PH) .GT. - 188.21606
04
FALSE
SEE NOTE ABOVE
TRUE
05
P0 = DEXP(-PH)
06
P1 = (P0 - 180)/(-PH)
P2 = (P1 - 180)/(-PH)
P3 = (P2 - (180/288))/(-PH)
07
P4 = (P3 - (180/480))/(-PH)
P5 = (P4 - (180/2400))/(-PH)
P6 = (P5 - (180/12000)) /(-PH)
** COMPUTE A CORRECTED VALUE OF T(N+1)
09
T6 = T0 + H*(A00*P1 + H*(A10*P2 + H*(200*A20*P3 + H*(600*A30*P4 + H*(2400*A40*P5 + H*12000*A50*P6))))
10
EXIT

ORIGINAL PAGE IS
OF POOR QUALITY

CHART TITLE - SUBROUTINE LOC(I,J,IX,S,S,SS)

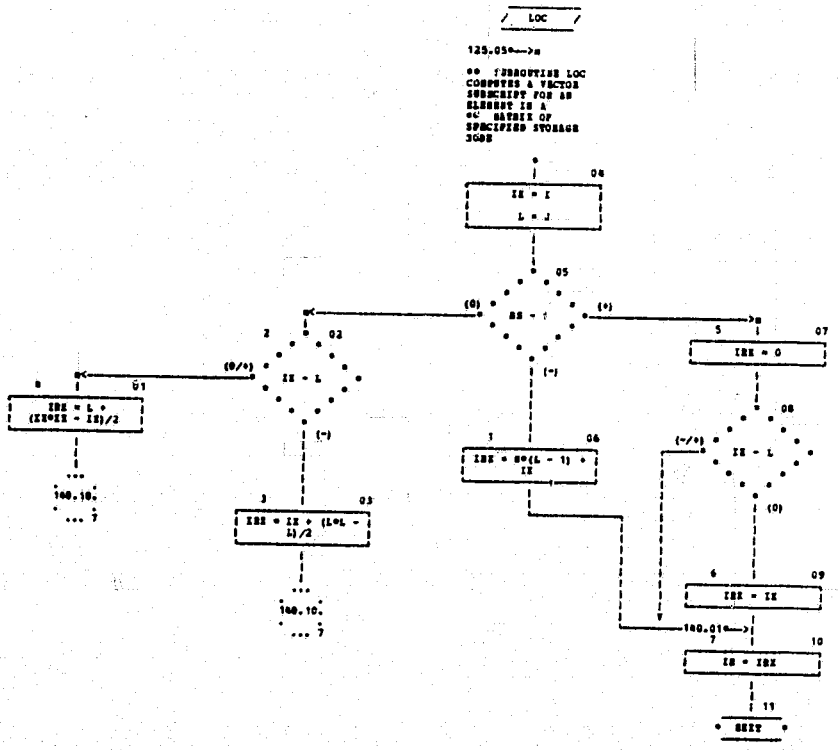
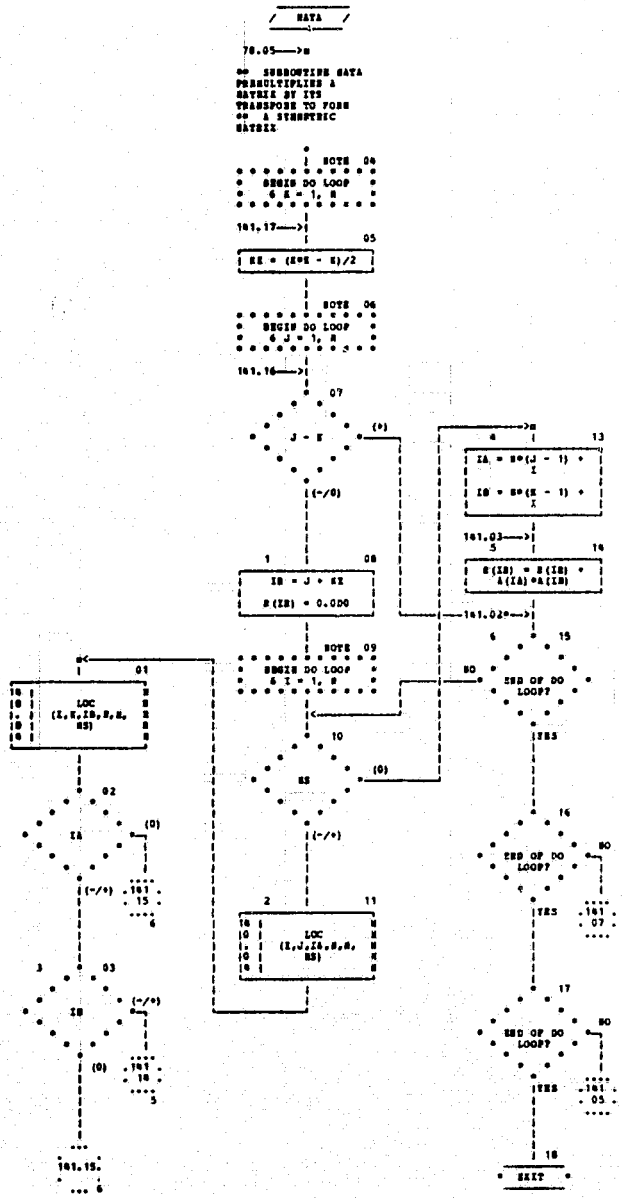


CHART TITLE - SUBROUTINE SATA(A,B,N,M,R,RS)



Sample Input – FDRI

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    1    1
    1
    1   15.2        3    8    3    6    5    4    2    7   10   11
  STIIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
    4    4    4    4 0.025    0.033    0.025    0.040    0.30    0.040
    0  -0.025
    0    1    1    1    1    0    1    0    0
155.0      3972.0     0.0323529 0.0323529 14.437     0.0          1.1538     -0.02
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  1.68894E0                   0.000       0.017453292500                 1.000
  459.720                -32.174100
12
117.333                  -0.045
132.0                    -0.025
146.667                  -0.010
161.333                  -0.002
176.0                     0.003
190.667                   0.007
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220.0                     0.012
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264.0                     0.013
278.667                   0.014
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1.27693241D+02-5.74877415D-01 3.65656156D+01                                653
7.36197010D+04-2.08643337D-02 7.09653157D-01 1.90540233D+00 1.41780350D+03  654
1.27600875D+02-1.02457989D-01 3.64097948D+01                                654
7.36198010D+04-2.52084725D-02 6.15415824D-01 1.87313148D+00 1.41901704D+03  655
1.27692257D+02-5.79902310D-01 3.64845034D+01                                655
7.36199010D+04-2.08643337D-02 5.51750564D-01 1.80954821D+00 1.41905381D+03  656
1.27511261D+02-4.22947340D-01 3.63081321D+01                                656
7.36200010D+04-2.51530690D-02 4.27886575D-01 1.77919423D+00 1.42269446D+03  657
1.28C686C9D+02-2.62341373D-02 3.64663597D+01                                657
7.36201010D+04-1.53344337D-02 5.20548213D-01 1.90476338D+00 1.42266994D+03  658
1.27879645D+02-5.43884387D-01 3.62208881D+01                                658
7.36202010D+04-2.08421723D-02 4.26310880D-01 1.80922874D+00 1.42024285D+03  659
1.27600875D+02-3.59608303D-01 3.63542963D+01                                659
7.36203010D+04-2.30031610D-02 3.63591037D-01 1.74724285D+00 1.42025510D+03  660
1.27696066D+02-3.06000000D-01 3.63884492D+01                                660
7.36204010D+04-1.97228954D-02 3.30106709D-01 1.87472887D+00 1.42143188D+03  661
1.27677763D+02-2.36477324D-01 3.64770325D+01                                661
7.36205010D+04-2.08421722D-02 1.08393038D-01 1.96738822D+00 1.41782801D+03  662
1.27414053D+02-2.90085052D-01 3.63212114D+01                                662
7.36206010D+04-2.29920804D-02-2.63892130D-01 1.74596495D+00 1.42146865D+03  663
1.27696066D+02-3.06000000D-01 3.62806549D+01                                663
7.36207010D+04-1.85592959D-02-1.38434703D-01 1.74596495D+00 1.42143188D+03  664
1.27683415D+02-1.04970588D-01 3.61098919D+01                                664
7.36208010D+04-1.42206971D-02-4.63065887D-02 1.74500652D+00 1.41780350D+03  665
1.27974635D+02-2.50716540D-01 3.66552659D+01                                665
7.36209010D+04-1.91189343D-02-1.70820838D-01 1.64979135D+00 1.41900479D+03  666
1.27786479D+02-1.09996332D-01 3.69028733D+01                                666
7.36210010D+04-1.53122722D-02-1.69248874D-01 1.61783998D+00 1.41780350D+03  667
1.27600875D+02-3.74664658D-01 3.67630613D+01                                667
7.36211010D+04-1.85814573D-02-1.14053125D-02 1.58684703D+00 1.41904156D+03  668
1.27697006D+02-5.38859308D-01 3.68740569D+01                                668

7.36212016D+04-1.63539844D-02 2.07430280D-01 1.65011083D+00 1.42145640D+03  669
1.27574635D+02-4.96978317D-01 3.66872852D+01                                669
7.36213010D+04-1.31180412D-02 2.99613148D-01 1.64915240D+00 1.42021834D+03  670
1.27781757D+02-5.37184059D-01 3.67619935D+01                                670
7.36214010D+04-1.86202396D-02 1.75366063D-01 1.55393723D+00 1.41779124D+03  671
1.27128581D+02-4.98653564D-01 3.65858946D+01                                671
7.36215010D+04-2.02271305D-02 2.06180233D-01 1.52326376D+00 1.41781575D+03  672
1.27224125D+02-6.56126434D-01 3.62657135D+01                                672
7.36216010D+04-1.63927667D-02 1.74108494D-01 1.61847893D+00 1.42025510D+03  673
1.27414053D+02-3.12701688D-01 3.64759648D+01                                673
7.36217010D+04-1.69468647D-02 7.91508445D-02 1.65011083D+00 1.42145640D+03  674
1.27685518D+02-4.88601379D-01 3.65293290D+01                                674
7.36216010D+04-1.74621806D-02-7.77495393D-02 1.64723555D+00 1.42025510D+03  675
1.27132357D+02-6.44400000D-01 3.65698850D+01                                675
7.36219010D+04-1.41486720D-02-2.00377443D-01 1.36254847D+00 1.42148091D+03  676
1.27601817D+02-5.87441685D-01 3.63863150D+01                                676
7.36220010D+04-1.19766031D-02-1.17197122D-02 1.36286794D+00 1.42265769D+03  677
1.27786479D+02-3.35317236D-01 3.64236688D+01                                677
7.36221010D+04-1.41597535D-02 1.77255124D-01 1.39322194D+00 1.41902930D+03  678
1.27598950D+02-4.42532267D-01 3.66371229D+01                                678
7.36222010D+04-1.30847992D-02 3.96684213D-01 1.26765278D+00 1.42026736D+03  679
1.27507459D+02-5.59800000D-01 3.65037148D+01                                679
7.36223010D+04-1.52568690D-02 5.22754176D-01 1.36510427D+00 1.42269446D+03  680
1.27696066D+02-4.00553244D-01 3.62531782D+01                                680
7.36224010D+04-1.30737186D-02 6.45987912D-01 1.61847893D+00 1.42265769D+03  681
1.27E758730+02-3.57932571D-01 3.65698843D+01                                681
 THIS MUST BE A BLANK CARD
 THIS MUST BE A BLANK CARD
100000100011
010000C001 -.123897583D0  0.0D0          1.0D0          20.0D0
000C0C00000000          PLOT CARD
   -1    10    10    10    10    10   -1    10    10   -1   -1
0.0D0                0.0D0
0.0D0                0.0D0
0.0E0                0.0D0
0.0E0                0.0D0
0.0E0                0.0D0
0.0E0                0.0D0
000101
END
```

ORIGINAL PAGE IS
OF POOR QUALITY

Sample Output — FDRI

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*****************************************************************
*                                                               *
*  ALT1T 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33  *
*                                                               *
*****************************************************************
```

```
                                        NSETS=  1
                                                        ICODE
 SECTION 1 INPUT PARAMETERS                               1

METRIC=    1  XLM(1)=   0.0200  FCR1=   0.032353  CF(1)=   0.0
NCM(1)=    4  XLM(2)=   0.0350  FCR2=   0.032353  CF(2)=   0.0
NCM(2)=    4  XLM(3)=   0.0250  XACG=  14.437000  CF(3)=   0.1750-01
NCM(3)=    4  TAU(1)=   0.0400  PCCG=   0.0       CF(4)=   0.1750-01
NCM(4)=    4  TAU(2)=   0.3000  CALP1=    1.1938  CF(5)=   0.1690 01
NCM(5)=    4  TAU(3)=   0.0400  CALP2=   -0.0200  CF(6)=   0.0
DM 198.6000      OUT= 3972.400000  NSP1S=    0    CF(7)=   0.1780-01
NSTS=  12                                         CF(8)=   0.1060 01
LSP(1)= 0  LSP(2)= 1  LSP(3)= 1  LSP(4)= 1        CF(9)=   0.4060 03
LSP(5)= 1  LSP(6)= 0  LSP(7)= 1  LSP(8)= 0        CF(10)=-0.3220 02
LSP(9)= 0  ELA= 18.290000   DRIFT=    -0.03      CF(11)=  0.0
                                                  CF(12)=  0.0

                VE          DPDCP
             117.3330    -0.040000
             132.6000    -0.025000
             144.6670    -0.010000
             161.3330    -0.002000
             176.0000     0.003000
             190.6670     0.007000
             205.3330     0.010000
             220.0000     0.012000
             234.6670     0.012000
             249.3330     0.013000
             264.0000     0.013000
             278.6670     0.014000
```

```
*****************************************************************
*                                                               *
*  WING AREA =     16.39997 M**2                                *
*  REFERENCE DENSITY =  1.225573364 KG/M**3                     *
*  ACCELERATION DUE TO GRAVITY =    9.8146 M/SEC**2             *
*  TOTAL TEST TIME =      32.9000 SECONDS                       *
*                                                               *
*****************************************************************
```

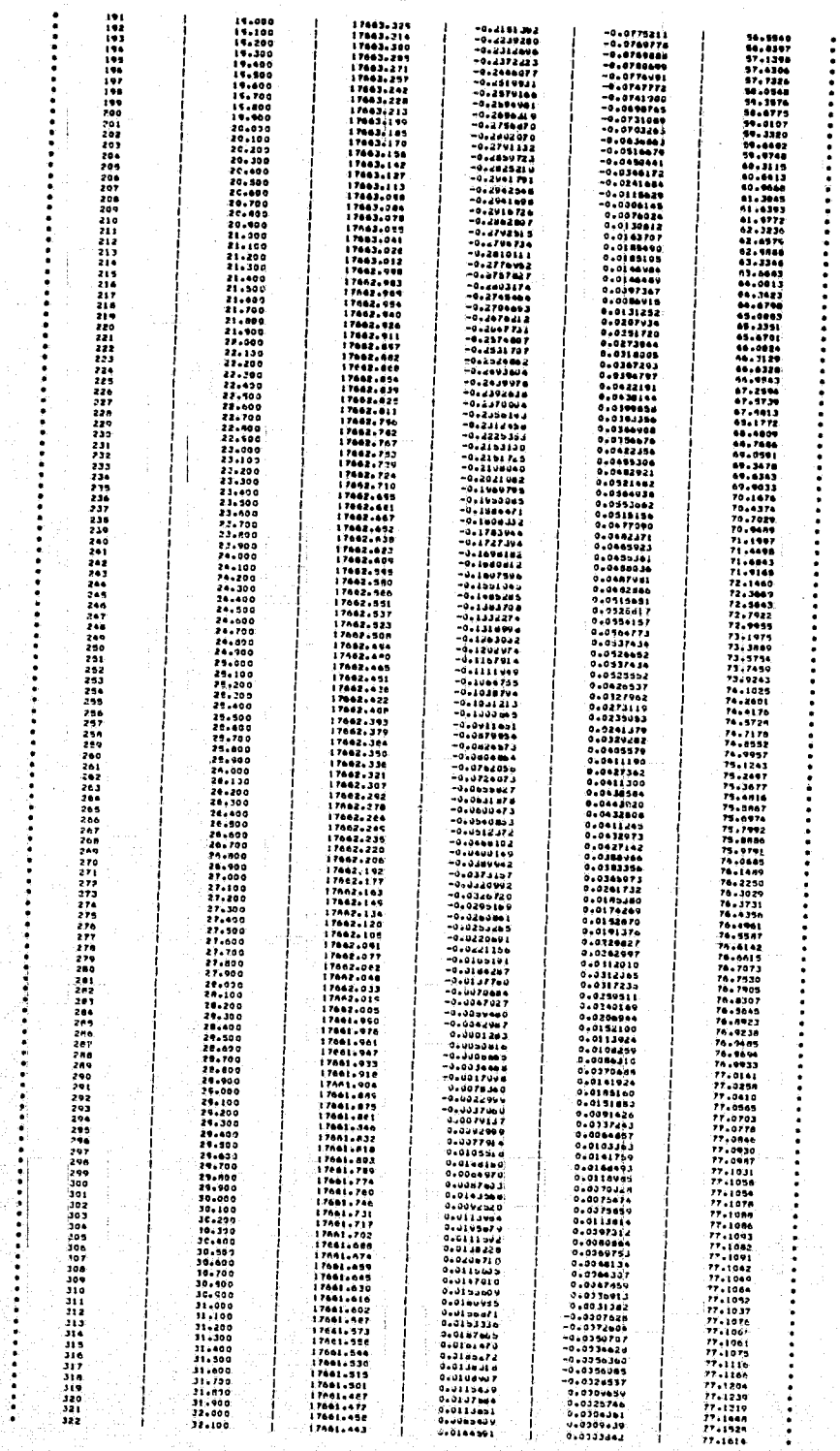
```
CALCULATED PHASE SHIFT COUNT =  0
CALCULATED PITCH ANGLE BIAS  =  4.431067620190D-02 RADIAN
CALCULATED PITCH RATE BIAS   = -2.654569654690D-03 RAD/SEC
```

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*****************************************************************
*                                                               *
*  CONVERSION OF INITIAL FLIGHT DATA TO COMPATIBLE UNITS        *
*                                                               *
*****************************************************************
```

DATA POINT	TIME (SECS)	WEIGHT (NEWTONS)	PITCH ANGLE (RADIANS)	PITCH RATE (RADIAN/SEC)	AIRSPEED (M/SEC)
1	0.0	17666.063	0.0038870	0.0088280	77.0687
2	0.100	17666.046	0.0033813	0.0056600	77.0698
3	0.200	17666.024	0.0023065	0.0031762	77.0123
4	0.300	17666.020	0.0017971	0.0050891	77.0365
5	0.400	17666.005	0.0030958	0.0058661	77.0617
6	0.500	17665.991	0.0014748	0.0067749	77.0991
7	0.600	17665.977	-0.0012917	0.0080076	78.0172
8	0.700	17665.962	0.0001106	0.0036948	78.0406
9	0.800	17665.948	0.0005998	0.0036493	78.0776
10	0.900	17665.933	0.0082080	0.0009849	78.1079
11	1.000	17665.919	0.0006222	0.0035092	78.1409
12	1.100	17665.905	0.0070737	0.0032581	78.1737
13	1.180	17665.890	0.0092033	0.0064588	78.2068
14	1.280	17665.876	0.0149065	0.0075308	78.2405
15	1.380	17665.861	0.0121709	0.0058806	78.2773
16	1.480	17665.847	0.0101712	0.0042688	78.3102
17	1.580	17665.833	0.0106557	0.0064472	78.3434
18	1.680	17665.818	0.0086017	0.0064307	78.3790
19	1.780	17665.804	0.0079998	0.0047894	78.4140
20	1.880	17665.790	0.0067397	0.0020141	78.4471
21	1.980	17665.775	0.0110497	-0.0012238	78.4803
22	2.080	17665.761	0.0133869	-0.0009275	78.5138
23	2.180	17665.746	0.0167431	-0.0012657	78.5454
24	2.280	17665.732	0.0138775	-0.0012293	78.5736
25	2.380	17665.718	0.0122352	0.0003732	78.6040
26	2.480	17665.703	0.0132997	-0.0033158	78.6387
27	2.580	17665.689	0.0089961	0.0064281	78.6693
28	2.680	17665.674	0.0082944	0.0031522	78.6988
29	2.780	17665.660	0.0086426	0.0037188	78.7171
30	2.880	17665.646	0.0125805	0.0058641	78.7369
31	2.980	17665.631	0.0113713	0.0025582	78.7471
32	3.080	17665.617	0.0118803	-0.0012293	78.7542
33	3.180	17665.602	0.0147464	0.0083842	78.7810
34	3.280	17665.588	0.0134585	-0.0012512	78.7838
35	3.380	17665.574	0.0159080	-0.0017671	78.7818
36	3.480	17665.559	0.0132293	0.0090684	78.7834
37	3.580	17665.545	0.0150969	0.0062578	78.7948
38	3.680	17665.530	0.0173983	0.0053195	78.7265
39	3.780	17665.516	0.0185164	0.0038021	78.7066
40	3.880	17665.502	0.0161132	0.0031797	78.6816
41	3.980	17665.487	0.0136309	0.0064197	78.6924
42	4.080	17665.473	0.0210649	0.0037028	78.6194
43	4.180	17665.459	0.0280921	0.0106168	78.5722
44	4.280	17665.444	0.0390403	0.0628692	78.5236
45	4.380	17665.430	-0.0530283	0.0770835	78.4687
46	4.480	17665.415	-0.0831994	0.0994884	78.4491
47	4.580	17665.401	0.0712380	0.1037295	78.3614
48	4.680	17665.387	0.0795962	0.0998388	78.2699
49	4.780	17665.372	0.0906869	0.0933935	78.1838
50	4.880	17665.358	0.1007631	0.0987104	78.0902
51	4.980	17665.343	0.1128901	0.1021728	78.0009
52	5.080	17665.329	0.1258067	0.1032810	77.9041
53	5.180	17665.315	0.1327486	0.1021493	77.7844
54	5.280	17665.300	0.1428068	0.1006678	77.6678
55	5.380	17665.286	0.1488983	0.0960184	77.5278
56	5.480	17665.271	0.1567375	0.0998773	77.4009
57	5.580	17665.257	0.1727430	0.0971615	77.2687
58	5.680	17665.243		0.0922383	
	5.780				

	59	5.850	17665.228	0.1821531	0.0001470	77.1075	
	60	5.900	17665.214	0.1898986	0.0978161	76.9685	
	61	5.950	17665.199	0.1933283	0.1933283	76.7797	
	62	6.000	17665.185	0.1966630	0.1966630	76.6040	
	63	6.050	17665.171	0.2000271	0.1998300	76.4206	
	64	6.100	17665.156	0.2361883	0.1998300	76.2320	
	65	6.150	17665.142	0.2454693	0.1963075	76.0295	
	66	6.200	17665.128	0.2956849	0.1910561	75.8149	
	67	6.250	17665.113	0.2949821	0.1908335	75.5902	
	68	6.300	17665.099	0.2782386	0.1827119	75.3702	
	69	6.350	17665.084	0.2881884	0.1927394	75.1307	
	70	6.400	17665.070	0.2998583	0.1942118	74.8995	
	71	6.450	17665.056	0.2853442	0.1819952	74.6863	
	72	6.500	17665.041	0.2192481	0.1980385	74.3935	
	73	6.550	17665.027	0.2276984	0.1977066	74.1225	
	74	6.600	17665.012	0.2386346	0.1120303	73.8533	
	75	6.650	17664.998	0.2666210	0.1987408	73.5798	
	76	6.700	17664.984	0.2996711	0.1985790	73.2843	
	77	6.750	17664.969	0.3786707	0.1982512	72.9870	
	78	6.800	17664.955	0.3837075	0.1120246	72.6873	
	79	6.850	17664.940	0.3032437	0.1982127	72.3757	
	80	6.900	17664.926	0.4084963	0.1982127	72.0559	
	81	6.950	17664.912	0.4184386	0.1981832	71.7316	
	82	7.000	17664.897	0.4470253	0.1932365	71.4031	
	83	7.050	17664.883	0.4662878	0.1909225	71.0745	
	84	7.100	17664.868	0.4871886	0.1916612	70.7211	
	85	7.150	17664.854	0.5081849	0.1966885	70.3667	
	86	7.200	17664.840	0.5382735	0.1109686	70.0107	
	87	7.250	17664.825	0.5611767	0.1091426	69.6666	
	88	7.300	17664.811	0.5911883	0.0981008	69.2976	
	89	7.350	17664.797	0.6284120	0.0781648	68.9196	
	90	7.400	17664.782	0.6662163	0.0619652	68.5402	
	91	7.450	17664.768	0.7025441	0.0588997	68.1793	
	92	7.500	17664.753	0.7429436	0.0581714	67.7977	
	93	7.550	17664.739	0.7871100	0.0621091	67.4091	
	94	7.600	17664.725	0.8333040	0.0227612	67.0252	
	95	7.650	17664.710	0.8818913	0.0210275	66.6398	
	96	7.700	17664.696	0.9316985	0.0196492	66.2638	
	97	7.750	17664.681	0.9173041	0.0195887	65.8526	
	98	7.800	17664.667	0.9629004	0.0135266	65.4840	
	99	7.850	17664.653	0.9114447	0.0076733	65.0984	
	100	7.900	17664.638	0.9849149	-0.0013390	64.6853	
	101	10.000	17664.624	0.9381121	-0.0106519	64.2511	
	102	10.100	17664.609	0.9124221	-0.0183458	63.8826	
	103	10.200	17664.595	0.8812982	-0.0270278	63.4853	
	104	10.300	17664.581	0.8496.868	-0.0318831	63.0670	
	105	10.400	17664.566	0.8190.429	-0.0324425	62.6595	
	106	10.500	17664.552	0.8017737	-0.0281141	62.2685	
	107	10.600	17664.537	0.8989479	-0.0259283	61.8770	
	108	10.700	17664.523	0.8947164	-0.0243338	61.4832	
	109	10.800	17664.509	0.8914869	-0.0261800	61.0911	
	110	10.900	17664.494	0.8823048	-0.0312690	60.7131	
	111	11.000	17664.480	0.8675844	-0.0366551	60.3369	
	112	11.100	17664.466	0.8594387	-0.0528897	59.9867	
	113	11.200	17664.451	0.8601935	-0.0567132	59.5722	
	114	11.300	17664.437	0.8572400	-0.0627624	59.2141	
	115	11.400	17664.422	0.8498123	-0.0699892	58.8624	
	116	11.500	17664.408	0.8436185	-0.0628710	58.4836	
	117	11.600	17664.394	0.8402226	-0.0588188	58.1277	
	118	11.700	17664.379	0.8403653	-0.0538488	57.7757	
	119	11.800	17664.365	0.8410357	-0.0508527	57.4355	
	120	11.900	17664.350	0.8419077	-0.0522990	57.1023	
	121	12.000	17664.336	0.8466847	-0.0539656	56.7737	
	122	12.100	17664.322	0.8548479	-0.0556082	56.4439	
	123	12.200	17664.307	0.8658208	-0.0559884	56.1400	
	124	12.300	17664.293	0.8783881	-0.0627588	55.8451	
	125	12.400	17664.278	0.8830756	-0.0676706	55.5224	
	126	12.500	17664.264	0.8830956	-0.0598965	55.2616	
	127	12.600	17664.250	0.8876463	-0.0753389	54.8776	
	128	12.700	17664.235	0.8988756	-0.0758838	54.6897	
	129	12.800	17664.221	0.9049386	-0.0762648	54.4186	
	130	12.900	17664.206	0.9029913	-0.0753753	54.1886	
	131	13.000	17664.192	0.8881414	-0.0797217	53.9364	
	132	13.100	17664.178	0.8696460	-0.0797.682	53.6970	
	133	13.200	17664.163	0.8580784	-0.0813571	53.4851	
	134	13.300	17664.149	0.8563873	-0.0802705	53.2602	
	135	13.400	17664.135	0.8589832	-0.0802705	53.0673	
	136	13.500	17664.120	0.8690871	-0.0802689	52.8562	
	137	13.600	17664.106	0.8881367	-0.0914111	52.6719	
	138	13.700	17664.091	0.9772427	-0.0913863	52.5001	
	139	13.800	17664.077	0.2268888	-0.0933144	52.3233	
	140	13.900	17664.063	0.2610293	-0.0830144	52.1988	
	141	14.000	17664.048	0.2968888	-0.0950034	52.0184	
	142	14.100	17664.034	0.2628890	-0.0919717	51.8475	
	143	14.200	17664.019	0.2247190	-0.0974376	51.7489	
	144	14.300	17664.005	0.2219712	-0.0906884	51.6618	
	145	14.400	17663.991	0.2138110	-0.0895963	51.5188	
	146	14.500	17663.976	0.2068236	-0.0890730	51.4269	
	147	14.600	17663.982	0.1931488	-0.0812928	51.3634	
	148	14.700	17663.947	0.1887622	-0.0929035	51.2868	
	149	14.800	17663.931	0.1800168	-0.0939736	51.2031	
	150	14.900	17663.916	0.1704222	-0.0923802	51.1988	
	151	15.000	17663.906	0.1600516	-0.0930791	51.1099	
	152	15.100	17663.890	0.1517703	-0.0928815	51.0887	
	153	15.200	17663.875	0.1420987	-0.0918114	51.0573	
	154	15.300	17663.861	0.1351206	-0.0934687	51.0430	
	155	15.400	17663.847	0.1217613	-0.0961687	51.0285	
	156	15.500	17663.832	0.1069175	-0.0945334	51.0201	
	157	15.600	17663.818	0.1014483	-0.0939826	51.0607	
	158	15.700	17663.804	0.0918.868	-0.0912701	51.0624	
	159	15.800	17663.789	0.0832988	-0.0748553	51.1131	
	160	15.900	17663.775	0.0766164	-0.0881852	51.1546	
	161	16.000	17663.760	0.0744.332	-0.0961707	51.1744	
	162	16.100	17663.746	0.0534114	-0.0954419	51.2298	
	163	16.200	17663.732	0.0418.434	-0.0961907	51.3076	
	164	16.300	17663.717	0.0346104	-0.0987614	51.4070	
	165	16.400	17663.703	0.0294678	-0.0994614	51.4459	
	166	16.500	17663.688	0.0118758	-0.0977590	51.5849	
	167	16.600	17663.674	0.0048842	-0.1308865	51.6704	
	168	16.700	17663.660	-0.0063612	-0.0994669	51.7568	
	169	16.800	17663.645	-0.0173859	-0.0983803	51.8771	
	170	16.900	17663.631	-0.0262487	-0.0983988	52.0319	
	171	17.000	17663.616	-0.0337311	-0.1008102	52.1556	
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	173	17.200	17663.588	-0.0560688	-0.0986896	52.4589	
	174	17.300	17663.573	-0.0619014	-0.0929035	52.6160	
	175	17.400	17663.559	-0.0721831	-0.0939856	52.8032	
	176	17.500	17663.544	-0.0784177	-0.0988183	52.9936	
	177	17.600	17663.530	-0.0881361	-0.0954712	53.1705	
	178	17.700	17663.516	-0.1011217	-0.0934134	53.3827	
	179	17.800	17663.501	-0.1074417	-0.0906976	53.5821	
	180	17.900	17663.487	-0.1197869	-0.0987194	53.7903	
	181	18.000	17663.473	-0.1306.376	-0.0928705	53.9808	
	182	18.100	17663.458	-0.1381472	-0.0986974	54.2114	
	183	18.200	17663.444	-0.1488381	-0.0906919	54.4008	
	184	18.300	17663.429	-0.1571988	-0.0901157	54.6913	
	185	18.400	17663.415	-0.1713792	-0.0948394	54.9228	
	186	18.500	17663.401	-0.1737707	-0.0952370	55.1895	
	187	18.600	17663.386	-0.1867817	-0.0979315	55.4568	
	188	18.700	17663.372	-0.1893633	-0.0857409	55.7206	
	189	18.800	17663.357	-0.1964937	-0.0829058	55.9874	
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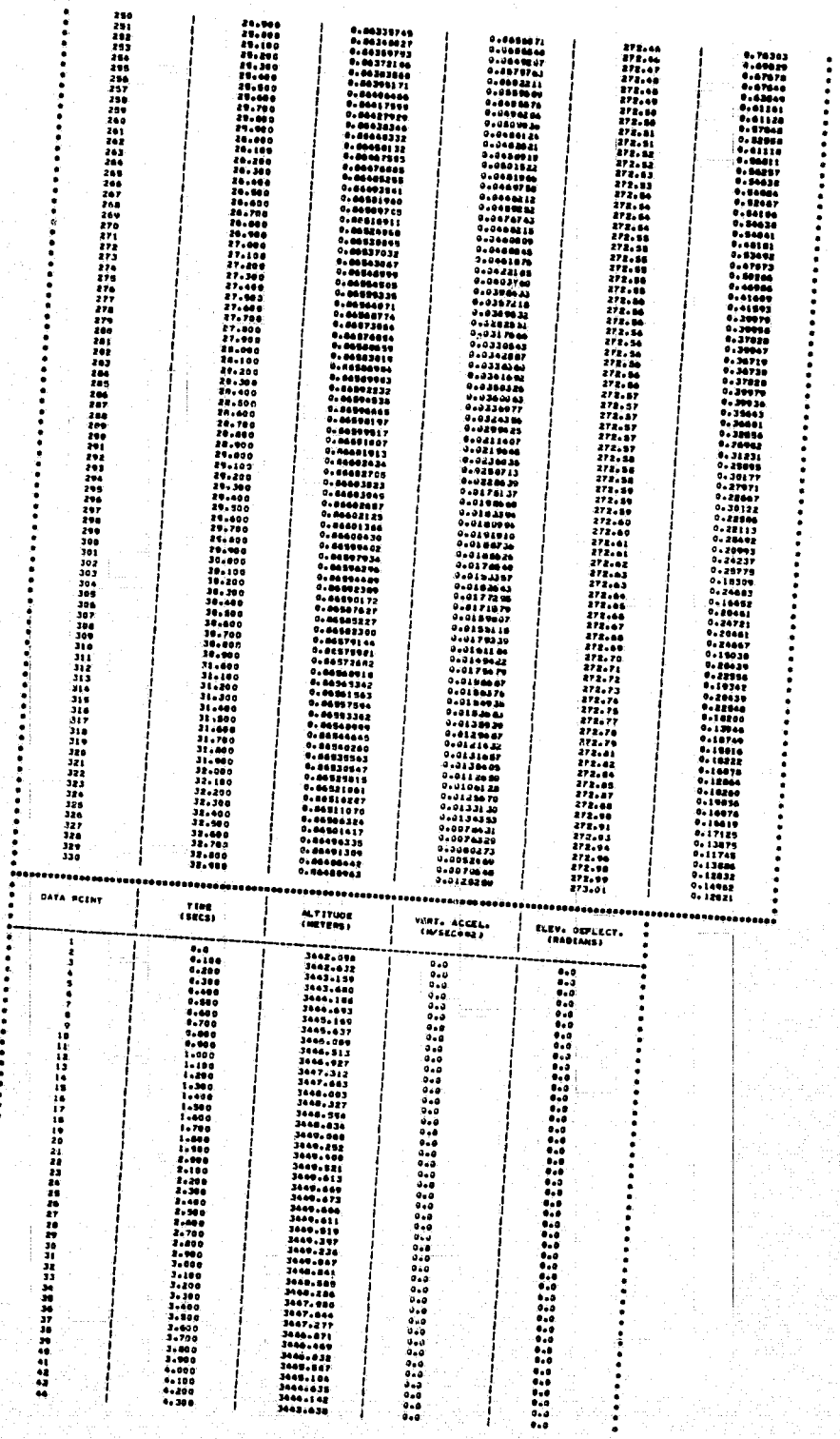


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329	32.800	17661.343	0.0123959	0.0084692	77.2679
330	32.900	17661.328	0.0130836	0.0086200	77.2881

DATA POINT	TIME (SECS)	DENSITY (KG/M**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-K)	LONG. ACCEL. (M/SEC**2)
1	0.0	0.86927615	0.0126156	272.92	0.07961
2	0.100	0.86922897	0.0076678	272.96	0.10115
3	0.200	0.86917826	0.0027570	272.98	0.12250
4	0.300	0.86913124	0.0048321	272.97	0.10631
5	0.400	0.86908547	0.0098626	272.99	0.10588
6	0.500	0.86903967	0.0098643	273.00	0.09882
7	0.600	0.86899488	0.0098360	273.02	0.12736
8	0.700	0.86895435	0.0081167	273.03	0.09279
9	0.800	0.86891382	0.0097671	273.08	0.12788
10	0.900	0.86887528	0.0093602	273.06	0.07420
11	1.000	0.86883795	0.0084273	273.08	0.11723
12	1.100	0.86880317	0.0068870	273.09	0.11702
13	1.200	0.86877149	0.0054188	273.11	0.09572
14	1.300	0.86874081	0.0120588	273.12	0.11748
15	1.400	0.86871182	0.0068310	273.14	0.13399
16	1.500	0.86868738	0.0072132	273.15	0.13886
17	1.600	0.86866577	0.0121809	273.16	0.12805
18	1.700	0.86864837	0.0114432	273.16	0.12261
19	1.800	0.86863282	0.0122577	273.19	0.11748
20	1.900	0.86861440	0.0105317	273.20	0.13337
21	2.000	0.86860365	0.0111011	273.21	0.11723
22	2.100	0.86859838	0.0121830	273.22	0.11748
23	2.200	0.86858638	0.0113731	273.23	0.13215
24	2.300	0.86858099	0.0107501	273.24	0.09888
25	2.400	0.86859041	0.0125232	273.25	0.09963
26	2.500	0.86859859	0.0088686	273.26	0.13884
27	2.600	0.86860393	0.0080263	273.27	0.10637
28	2.700	0.86861492	0.0077813	273.28	0.10828
29	2.800	0.86862941	0.0091617	273.29	0.09806
30	2.900	0.86864648	0.0102845	273.30	0.09828
31	3.000	0.86866508	0.0091780	273.30	0.11202
32	3.100	0.86868825	0.0069068	273.31	0.13337
33	3.200	0.86871825	0.0099874	273.32	0.11718
34	3.300	0.86874289	0.0118071	273.32	0.11175
35	3.400	0.86877321	0.0075331	273.33	0.10626
36	3.500	0.86880637	0.0084613	273.33	0.09572
37	3.600	0.86884301	0.0093929	273.33	0.11718
38	3.700	0.86887932	0.0088386	273.34	0.11153
39	3.800	0.86891876	0.0089902	273.34	0.08488
40	3.900	0.86896075	0.0096621	273.35	0.10884
41	4.000	0.86900261	0.0098108	273.35	0.07306
42	4.100	0.86904495	0.0110356	273.35	0.06469
43	4.200	0.86908952	0.0080783	273.35	0.06191
44	4.300	0.86913647	0.0098822	273.35	0.17266
45	4.400	0.86918041	0.0102915	273.35	0.25917
46	4.500	0.86922599	0.0120241	273.35	0.32468
47	4.600	0.86927029	0.0125804	273.35	0.40878
48	4.700	0.86931509	0.0103980	273.35	0.48044
49	4.800	0.86935970	0.0103898	273.35	0.52667
50	4.900	0.86940303	0.0044983	273.35	0.54193
51	5.000	0.86944367	0.0048617	273.35	0.63258
52	5.100	0.86948351	0.0051924	273.35	0.69044
53	5.200	0.86952352	0.0061137	273.35	0.73163
54	5.300	0.86955836	0.0040981	273.34	0.77476
55	5.400	0.86958039	0.0022878	273.34	0.79670
56	5.500	0.86959251	0.0010325	273.34	0.83982
57	5.600	0.86958069	0.0071920	273.34	0.85091
58	5.700	0.86957267	0.0070890	273.33	0.88279
59	5.800	0.86960268	0.0052219	273.33	0.86958
60	5.900	0.86970950	0.0066829	273.32	0.88076
61	6.000	0.86972207	0.0070134	273.32	0.90827
62	6.100	0.86972849	0.0073269	273.31	0.94364
63	6.200	0.86973803	0.0075409	273.31	1.00863
64	6.300	0.86972654	0.0079279	273.30	1.00363
65	6.400	0.86971769	0.0079431	273.30	1.10841
66	6.500	0.86970390	0.0081119	273.29	1.10892
67	6.600	0.86968846	0.0084188	273.29	1.11138
68	6.700	0.86965632	0.0083398	273.28	1.12214
69	6.800	0.86962786	0.0086836	273.27	1.12225
70	6.900	0.86958868	0.0089852	273.27	1.13267
71	7.000	0.86954810	0.0092252	273.26	1.13585
72	7.100	0.86949197	0.0080470	273.25	1.14419
73	7.200	0.86943737	0.0086876	273.24	1.17829
74	7.300	0.86937058	0.0089731	273.24	1.16086
75	7.400	0.86929522	0.0086402	273.23	1.23060
76	7.500	0.86921928	0.0083741	273.22	1.21452
77	7.600	0.86913811	0.0076790	273.21	1.22023
78	7.700	0.86906515	0.0092137	273.20	1.25303
79	7.800	0.86894841	0.0093358	273.19	1.30649
80	7.901	0.86886594	0.0095835	273.18	1.29628
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86	8.500	0.86809766	0.0100240	273.12	1.38084
87	8.600	0.86794365	0.0100838	273.11	1.40983
88	8.700	0.86779560	0.0098625	273.10	1.39226
89	8.800	0.86764490	0.0101573	273.09	1.34638
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91	9.000	0.86731414	0.0096178	273.06	1.23027
92	9.100	0.86714880	0.0098308	273.05	1.18145
93	9.200	0.86697739	0.0088737	273.04	1.13706
94	9.300	0.86679726	0.0090691	273.03	1.09977
95	9.400	0.86661956	0.0082173	273.01	1.11096
96	9.500	0.86643539	0.0080141	273.00	1.06712
97	9.600	0.86624920	0.0078710	272.99	1.00728
98	9.700	0.86606389	0.0075173	272.98	1.00206
99	9.800	0.86587932	0.0092699	272.96	0.98284
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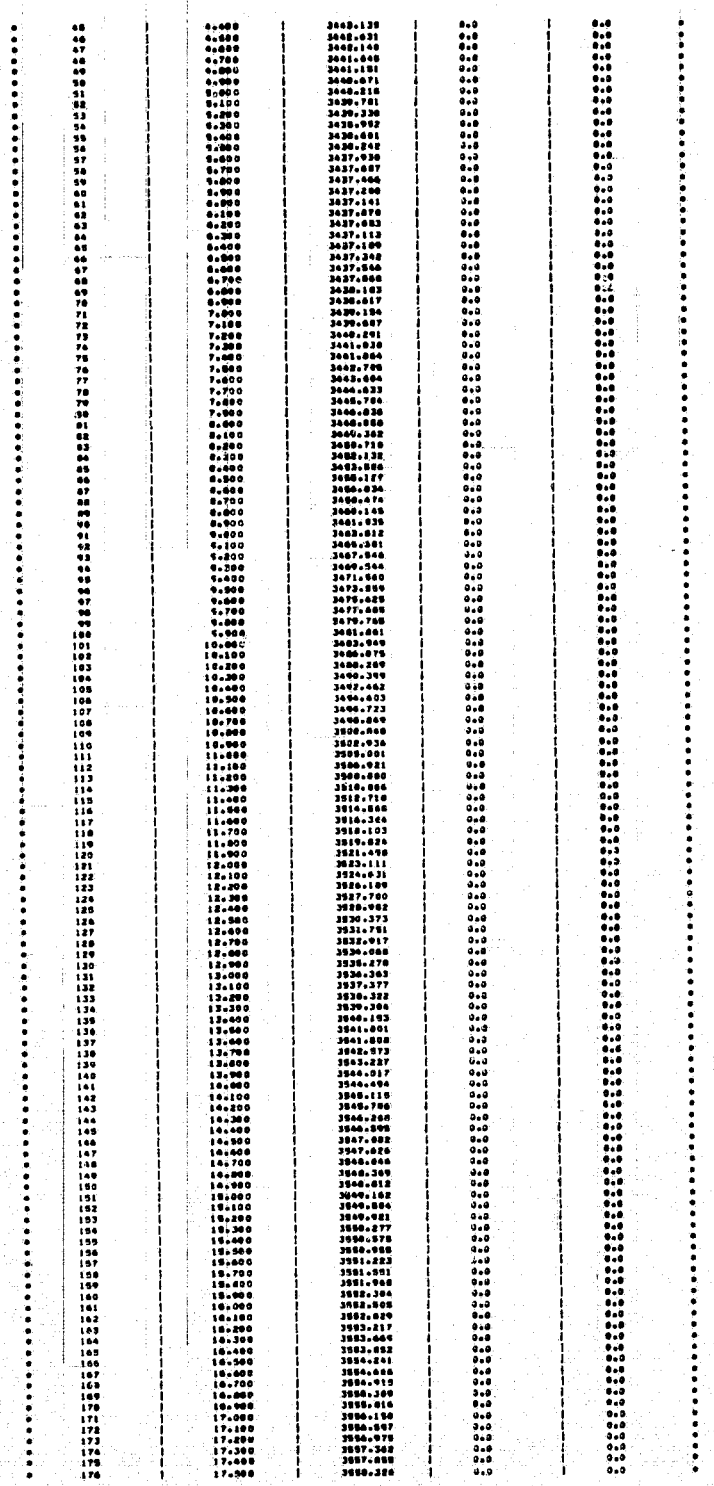
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216	21.500	0.00018028	0.0211718	272.09	0.78616
217	21.600	0.00015013	0.0207857	272.10	0.78530
218	21.700	0.00016423	0.0206476	272.11	0.77666
219	21.800	0.00013772	0.0208970	272.12	0.78014
220	21.900	0.00013621	0.0209811	272.13	0.78649
221	22.000	0.00014610	0.0202467	272.14	0.81778
222	22.100	0.00013341	0.0208177	272.15	0.79649
223	22.200	0.00010179	0.0208419	272.16	0.81810
224	22.300	0.00010241	0.0202184	272.17	0.82875
225	22.400	0.00009844	0.0206641	272.18	0.81037
226	22.500	0.00011925	0.0207804	272.20	0.80617
227	22.600	0.00026689	0.0206623	272.21	0.87187
228	22.700	0.00017070	0.0206878	272.22	0.82907
229	22.800	0.00015322	0.0204822	272.23	0.80026
230	22.900	0.00013397	0.0208130	272.24	0.81805
231	23.000	0.00076503	0.0206863	272.25	0.82356
232	23.100	0.00009640	0.0203124	272.27	0.83083
233	23.200	0.00010213	0.0202874	272.28	0.80536
234	23.300	0.00011788	0.0207124	272.29	0.82075
235	23.400	0.00013128	0.0207130	272.30	0.81832
236	23.500	0.00014890	0.0209362	272.31	0.85958
237	23.600	0.00019939	0.0206816	272.32	0.85020
238	23.700	0.00017326	0.0209096	272.34	0.82723
239	23.800	0.00018889	0.0209042	272.35	0.82886
240	23.900	0.00020090	0.0207253	272.36	0.82848
241	24.000	0.00019026	0.0206856	272.37	0.79089
242	24.100	0.00020781	0.0207042	272.38	0.79849
243	24.200	0.00024746	0.0205328	272.39	0.81767
244	24.300	0.00025194	0.0206370	272.40	0.72852
245	24.400	0.00026860	0.0206246	272.41	0.79805
246	24.500	0.00023331	0.0206819?	272.42	0.77866
247	24.600	0.00020387	0.0206820	272.43	0.76399
248	24.700	0.00019937	0.0206290	272.44	0.79826
249	24.800	0.00022644	0.0206860	272.45	0.73142



DATA PCINT	TIME (SECS)	ALTITUDE (METERS)	VERT. ACCEL. (M/SEC**2)	ELEV. DEFLECT. (RADIANS)
1	0.0	3462.098	0.0	0.0
2	0.100	3462.672	0.0	0.0
3	0.200	3463.159	0.0	0.0
4	0.300	3463.680	0.0	0.0
5	0.400	3464.186	0.0	0.0
6	0.500	3464.693	0.0	0.0
7	0.600	3465.199	0.0	0.0
8	0.700	3465.637	0.0	0.0
9	0.800	3466.099	0.0	0.0
10	0.900	3466.512	0.0	0.0
11	1.000	3466.927	0.0	0.0
12	1.100	3467.312	0.0	0.0
13	1.200	3467.683	0.0	0.0
14	1.300	3468.093	0.0	0.0
15	1.400	3468.327	0.0	0.0
16	1.500	3468.556	0.0	0.0
17	1.600	3468.836	0.0	0.0
18	1.700	3469.088	0.0	0.0
19	1.800	3469.292	0.0	0.0
20	1.900	3469.480	0.0	0.0
21	2.000	3469.521	0.0	0.0
22	2.100	3469.613	0.0	0.0
23	2.200	3469.669	0.0	0.0
24	2.300	3469.672	0.0	0.0
25	2.400	3469.666	0.0	0.0
26	2.500	3469.611	0.0	0.0
27	2.600	3469.819	0.0	0.0
28	2.700	3469.397	0.0	0.0
29	2.800	3469.236	0.0	0.0
30	2.900	3469.067	0.0	0.0
31	3.000	3468.841	0.0	0.0
32	3.100	3468.589	0.0	0.0
33	3.200	3468.286	0.0	0.0
34	3.300	3467.980	0.0	0.0
35	3.400	3467.644	0.0	0.0
36	3.500	3467.277	0.0	0.0
37	3.600	3466.871	0.0	0.0
38	3.700	3466.469	0.0	0.0
39	3.800	3466.038	0.0	0.0
40	3.900	3465.587	0.0	0.0
41	4.000	3465.104	0.0	0.0
42	4.100	3464.635	0.0	0.0
43	4.200	3464.142	0.0	0.0
44	4.300	3463.638	0.0	0.0

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309	30.900	3481.058	0.0	0.0
310	30.900	3481.424	0.0	0.0
311	31.000	3481.842	0.0	0.0
312	31.100	3482.239	0.0	0.0
313	31.200	3482.659	0.0	0.0
314	31.300	3483.100	0.0	0.0
315	31.400	3483.570	0.0	0.0
316	31.500	3484.096	0.0	0.0
317	31.600	3484.938	0.0	0.0
318	31.700	3485.029	0.0	0.0
319	31.800	3485.946	0.0	0.0
320	31.900	3486.106	0.0	0.0
321	32.000	3486.629	0.0	0.0
322	32.100	3487.157	0.0	0.0
323	32.200	3487.688	0.0	0.0
324	32.300	3488.267	0.0	0.0
325	32.400	3488.795	0.0	0.0
326	32.500	3489.360	0.0	0.0
327	32.600	3490.808	0.0	0.0
328	32.700	3490.462	0.0	0.0
329	32.800	3491.086	0.0	0.0
330	32.900	3491.613	0.0	0.0

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                SECTION 2 INPUT PARAMETERS

 IPS(1)= 1   NC(1)= -1   IP(1)= 0   IP(13)= 0
 IPS(2)= 0   NC(2)= 10   IP(2)= 0   IP(14)= 0
 IPS(3)= 0   NC(3)= 10   IP(3)= 0   IPRC(1)= 0
 IPS(4)= 0   NC(4)= 10   IP(4)= 0   IPRC(2)= 1
 IPS(5)= 0   NC(5)= 10   IP(5)= 0   IPRC(3)= 0
 IPS(6)= 0   NC(6)= 10   IP(6)= 0   IPRC(4)= 0
 IPS(7)= 1   NC(7)= -1   IP(7)= 0   IPRC(5)= 0
 IPS(8)= 0   NC(8)= 10   IP(8)= 0   IPRC(6)= 0
 IPS(9)= 0   NC(9)= 10   IP(9)= 0   IPRC(7)= 0
 IPS(10)=1   NC(10)=-1   IP(10)=0   IPRC(8)= 0
 IPS(11)=1   NC(11)=-1   IP(11)=0   IPRC(9)= 1
 KAX= -0.12380758        IP(12)=0

 AP(1)= 1.000000000000D-10      W(1)= 0.0
 AP(2)= 1.000000000000D-10      W(2)= 0.0
 AP(3)= 1.000000000000D-10      W(3)= 0.0
 AP(4)= 1.000000000000D-10      W(4)= 0.0
 AP(5)= 1.000000000000D-10      W(5)= 0.0
 AP(6)= 1.000000000000D-10      W(6)= 0.0

COMPATIBILITY ESTIMATES OF THE |  BIAS =   9.385042401970200D-04
BIAS AND GAINS BETWEEN INPUT   |-> FIRST-ORDER GAIN =   9.271566450311670-01
AND CALCULATED ANGLE OF ATTACK |  SECOND-ORDER GAIN =  9.6781323VJ6780820-01

ANGLE-OF-ATTACK VARIANCE INDICATION =  2.111V1300-04

COMPATIBILITY ESTIMATES OF THE |  BIAS =   3.5665451V4413730-04
BIAS AND GAINS BETWEEN INPUT   |-> FIRST-ORDER GAIN =   9.9091267576996020-01
AND CALCULATED ANGLE OF ATTACK |  SECOND-ORDER GAIN =  3.3287257517299700-02

ANGLE-OF-ATTACK VARIANCE INDICATION =  1.7583J90-05

COMPATIBILITY ESTIMATES OF THE |  BIAS =   2.6667J8647282840-04
BIAS AND GAINS BETWEEN INPUT   |-> FIRST-ORDER GAIN =   1.J0029995014821?J 00
AND CALCULATED ANGLE OF ATTACK |  SECOND-ORDER GAIN =  -2.261859R2J788640-02

ANGLE-OF-ATTACK VARIANCE INDICATION =  2.107208D-05

 ITERATION 1    SUBITERATION 1

 COST FUNCTION (J) =  0.1895286898646900-03
 WITH:
      STATIC PRESSURE TOLERANCE =  4.40431J1886080660J-03
      LONGITUDINAL ACCELERATION TOLERANCE =  4.7e3J0190441e2500-04


      1ST LINEAR ACCELERATION DEPENDUENCY DELTA=  J.0
      2ND LINEAR ACCELERATION DEPENDUENCY DELTA=  J.0
      3RD LINEAR ACCELERATION DEPENDUENCY DELTA=  J.0
      PITCH ANGLE BIAS DELTA =  -0.6662820-03
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      PHASE SHIFT DELTA =  0.0
      FLIGHT PATH ANGLE DELTA= -0.2339810-02

          UPDATED 1ST LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 2ND LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 3RD LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED PITCH ANGLE BIAS= -0.6662840-03
          UPDATED PHASE SHIFT=  0.0
          UPDATED FLIGHT PATH ANGLE BIAS= -0.2339810-02


ITERATION 1    SUBITERATION 2

COST FUNCTION (J) =  2.2679992828199970D-02
WITH:
     STATIC PRESSURE TOLERANCE =  2.3068468847579988D-01
     LONGITUDINAL ACCELERATION TOLERANCE =  1.3225388727970168D-03


      1ST LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      2ND LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      3RD LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      PITCH ANGLE BIAS DELTA =  0.5339400-03
      PHASE SHIFT DELTA =  0.0
      FLIGHT PATH ANGLE DELTA=  0.3297260-02

          UPDATED 1ST LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 2ND LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 3RD LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED PITCH ANGLE BIAS= -0.1307130-03
          UPDATED PHASE SHIFT=  0.0
          UPDATED FLIGHT PATH ANGLE BIAS=  0.9582760-03


ITERATION 1    SUBITERATION 3

COST FUNCTION (J) =  8.2585768826365100-03
WITH:
     STATIC PRESSURE TOLERANCE =  1.2908150478162760D-02
     LONGITUDINAL ACCELERATION TOLERANCE =  3.6285218860855660-04


      1ST LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      2ND LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      3RD LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      PITCH ANGLE BIAS DELTA = -0.8419670-04
      PHASE SHIFT DELTA =  0.0
      FLIGHT PATH ANGLE DELTA= -0.5205210-03

          UPDATED 1ST LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 2ND LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 3RD LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED PITCH ANGLE BIAS= -0.2168190-03
          UPDATED PHASE SHIFT=  0.0
          UPDATED FLIGHT PATH ANGLE BIAS=  0.4375530-03


ITERATION 1    SUBITERATION 4

COST FUNCTION (J) =  5.8894188859758870D-03
WITH:
     STATIC PRESSURE TOLERANCE =  7.7406881946151370D-04
     LONGITUDINAL ACCELERATION TOLERANCE =  3.4402363715664178D-04


      1ST LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      2ND LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      3RD LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      PITCH ANGLE BIAS DELTA =  0.1324210-04
      PHASE SHIFT DELTA =  0.0
      FLIGHT PATH ANGLE DELTA=  0.8186570-04

          UPDATED 1ST LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 2ND LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 3RD LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED PITCH ANGLE BIAS= -0.2018770-03
          UPDATED PHASE SHIFT=  0.0
          UPDATED FLIGHT PATH ANGLE BIAS=  0.3196190-03


ITERATION 1    SUBITERATION 5

COST FUNCTION (J) =  5.8670843604491400-03
WITH:
     STATIC PRESSURE TOLERANCE =  1.4981996567344421D0-03
     LONGITUDINAL ACCELERATION TOLERANCE =  3.4271411363231930D-04


      1ST LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      2ND LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      3RD LINEAR ACCELERATION DEPENDENCY DELTA=  0.0
      PITCH ANGLE BIAS DELTA = -0.2082640-05
      PHASE SHIFT DELTA =  0.0
      FLIGHT PATH ANGLE DELTA= -0.1287530-04

          UPDATED 1ST LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 2ND LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED 3RD LINEAR ACCELERATION DEPENDENCY=   0.0
          UPDATED PITCH ANGLE BIAS= -0.2037660-03
          UPDATED PHASE SHIFT=  0.0
          UPDATED FLIGHT PATH ANGLE BIAS=  0.3067630-03


ITERATION 1    SUBITERATION 6

COST FUNCTION (J) =  5.8668028951716590D-03
WITH:
     STATIC PRESSURE TOLERANCE =  1.3580147464228800D-03
     LONGITUDINAL ACCELERATION TOLERANCE =  3.4401385877011870D-04


    OF THE ABOVE  6 ITERATIONS, THE BEST COST FUNCTION HAS BEEN
    CHOSEN TO BE EQUAL TO  0.586702843695849140-02, AND THE VALUES
    ASSOCIATED WITH THIS COST FUNCTION (PHASE SHIFT VALUE IS SUB-
    JECT TO A MAGNITUDE AND SIGN RESTRICTION) WILL BE USED TO MOD-
    IFY DATA.


COMPATIBILITY ESTIMATES OF THE |   BIAS =  0.7612956884468150-06
BIAS AND GAINS BETWEEN INPUT   |-> FIRST-ORDER GAIN  =  0.3188898868291040-01
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AND CALCULATED ANGLE OF ATTACK | SECOND-ORDER GAIN = 9.0494923469688810-01

ANGLE-OF-ATTACK VARIANCE INDICATION = 2.0607230-06

COMPATIBILITY ESTIMATES OF THE | BIAS = 3.5483829758373890-06
BIAS AND GAINS BETWEEN INPUT |-> FIRST-ORDER GAIN = 9.9077859437200300-01
AND CALCULATED ANGLE OF ATTACK | SECOND-ORDER GAIN = 9.8971377674680590-02

ANGLE-OF-ATTACK VARIANCE INDICATION = 1.7052130-05

COMPATIBILITY ESTIMATES OF THE | BIAS = 2.8919618405360770-06
BIAS AND GAINS BETWEEN INPUT |-> FIRST-ORDER GAIN = 9.9961033985720360-01
AND CALCULATED ANGLE OF ATTACK | SECOND-ORDER GAIN = -1.5039151944861880-02

ANGLE-OF-ATTACK VARIANCE INDICATION = 2.0220490-05

COST FUNCTION (J) = 8.3832076277094000-03
WITH:
STATIC PRESSURE TOLERANCE = 4.1763068880648411DD-03
LONGITUDINAL ACCELERATION TOLERANCE = 6.8376357620583830D-04

FOURIER SERIES ANALYSIS WITH SPECIFIED HARMONICS

DATA POINT	TIME (SECS)	WEIGHT (NEWTONS)	PITCH ANGLE (RADIANS)	PITCH RATE (RADIAN/SEC)	AIRSPEED (M/SEC)
1	0.0	17686.063	0.0009868	0.0008116	77.9111
2	0.100	17686.049	0.0002360	0.0015716	77.9177
3	0.200	17686.036	0.0004881	0.0026112	77.9244
4	0.300	17686.020	0.0007776	0.0033076	77.9311
5	0.400	17686.005	0.0012572	0.0042456	77.9377
6	0.500	17685.991	0.0018895	0.0051610	77.9443
7	0.600	17685.977	0.0026046	0.0060651	77.9506
8	0.700	17685.965	0.0034644	0.0069281	77.9567
9	0.800	17685.948	0.0043829	0.0077693	77.9625
10	0.900	17685.933	0.0053885	0.0082596	77.9680
11	1.000	17685.919	0.0064342	0.0087152	77.9731
12	1.100	17685.905	0.0074989	0.0089849	77.9778
13	1.200	17686.890	0.0085214	0.0090892	77.9820
14	1.300	17685.876	0.0095648	0.0088782	77.9858
15	1.400	17685.861	0.0105026	0.0084763	77.9890
16	1.500	17685.847	0.0113427	0.0078436	77.9918
17	1.600	17685.833	0.0120375	0.0069569	77.9941
18	1.700	17685.818	0.0126244	0.0058813	77.9959
19	1.800	17685.804	0.0130283	0.0046709	77.9973
20	1.900	17685.790	0.0132674	0.0031196	77.9983
21	2.000	17685.775	0.0132844	0.0015502	77.9990
22	2.100	17685.761	0.0131268	-0.0000863	77.9993
23	2.200	17685.746	0.0126128	-0.0017313	77.9994
24	2.300	17685.732	0.0123281	-0.0033203	77.9992
25	2.400	17685.718	0.0117089	-0.0047841	77.9990
26	2.500	17685.703	0.0109858	-0.0060510	77.9988
27	2.600	17685.689	0.0101892	-0.0070490	77.9982
28	2.700	17685.674	0.0093781	-0.0077073	77.9977
29	2.800	17685.660	0.0086300	-0.0079591	77.9973
30	2.900	17685.646	0.0079140	-0.0077437	77.9969
31	3.000	17685.631	0.0073753	-0.0070086	77.9965
32	3.100	17685.617	0.0070033	-0.0059113	77.9961
33	3.200	17685.602	0.0070106	-0.0038213	77.9956
34	3.300	17685.588	0.0073107	-0.0013212	77.9950
35	3.400	17685.574	0.0080152	0.0017920	77.9942
36	3.500	17685.559	0.0091819	0.0053063	77.9931
37	3.600	17685.545	0.0108611	0.0097981	77.9915
38	3.700	17685.530	0.0131043	0.0148167	77.9892
39	3.800	17685.516	0.0159436	0.0199157	77.9860
40	3.900	17685.502	0.0194097	0.0238241	77.9816
41	4.000	17685.487	0.0233221	0.0256631	77.9757
42	4.100	17685.473	0.0269201	0.0279650	77.9679
43	4.200	17685.459	0.0317128	0.0443756	77.9577
44	4.300	17685.444	0.0397792	0.0508574	77.9446
45	4.400	17685.430	0.0494667	0.0572915	77.9281
46	4.500	17685.415	0.0617516	0.0628813	77.9075
47	4.600	17685.401	0.0765904	0.0678348	77.8822
48	4.700	17685.387	0.0949407	0.0753673	77.8515
49	4.800	17685.372	0.0787547	0.0807063	77.8148
50	4.900	17685.358	0.0879728	0.0858030	77.7714
51	5.000	17685.343	0.0975431	0.0899547	77.7206
52	5.100	17685.329	0.1074130	0.0937853	77.6618
53	5.200	17685.315	0.1175410	0.0970567	77.5945
54	5.300	17685.300	0.1278180	0.0997646	77.5182
55	5.400	17685.286	0.1382490	0.1019283	77.4325
56	5.500	17685.271	0.1487760	0.1035700	77.3370
57	5.600	17685.257	0.1593891	0.1047329	77.2315
58	5.700	17685.243	0.1699675	0.1054700	77.1159
59	5.800	17685.228	0.1805775	0.1058623	76.9901
60	5.900	17685.214	0.1911729	0.1059214	76.8542
61	6.000	17685.199	0.2017467	0.1057769	76.7082
62	6.100	17685.185	0.2122911	0.1054835	76.5522
63	6.200	17685.171	0.2228186	0.1051128	76.3863
64	6.300	17685.156	0.2333289	0.1047313	76.2108
65	6.400	17685.142	0.2438430	0.1043990	76.0258
66	6.500	17685.128	0.2543762	0.1041665	75.8315
67	6.600	17685.113	0.2649400	0.1040880	75.6280
68	6.700	17685.099	0.2755572	0.1041364	75.4153
69	6.800	17685.084	0.2864410	0.1043728	75.1937
70	6.900	17685.070	0.2976047	0.1047803	74.9631
71	7.000	17685.056	0.3078967	0.1033385	74.7239
72	7.100	17685.041	0.3187901	0.1068152	74.4780
73	7.200	17685.027	0.3296112	0.1067685	74.2175
74	7.300	17685.012	0.3404041	0.1078332	73.9510
75	7.400	17684.998	0.3520643	0.1062528	73.6753
76	7.500	17684.984	0.3632193	0.1088526	73.3906
77	7.600	17684.969	0.3743788	0.1092862	73.0963
78	7.700	17684.955	0.3856685	0.1093862	72.7930
79	7.800	17684.940	0.3966902	0.1091667	72.4805
80	7.900	17684.926	0.4073284	0.1088261	72.1588
81	8.000	17684.912	0.4179708	0.1073995	71.8286
82	8.100	17684.897	0.4283253	0.1057217	71.4896
83	8.200	17684.883	0.4383479	0.1034787	71.1421
84	8.300	17684.868	0.4479468	0.1006097	70.7836
85	8.400	17684.854	0.4570627	0.0971083	70.4172
86	8.500	17684.840	0.4656925	0.0929730	70.0473
87	8.600	17684.825	0.4737189	0.0882180	69.6686
88	8.700	17684.811	0.4811122	0.0828723	69.2838
89	8.800	17684.797	0.4878297	0.0768794	68.8931
90	8.900	17684.782	0.4938288	0.0705960	68.4975
91	9.000	17684.768	0.4991060	0.0637901	68.0978
92	9.100	17684.753	0.5036208	0.0566396	67.6967
93	9.200	17684.739	0.5073725	0.0492268	67.2888

94	9.300	17684.725	0.5103818	0.8616482	66.4889
95	9.400	17684.710	0.5125974	0.8139698	66.4715
96	9.500	17684.696	0.5148173	0.8263446	66.0614
97	9.600	17684.681	0.5169884	0.8188028	65.6812
98	9.700	17684.667	0.5192780	0.8114472	65.2612
99	9.800	17684.653	0.5214822	0.8043552	64.8321
100	9.900	17684.638	0.5233260	-0.0324059	64.8261
101	10.000	17684.626	0.5116.80	-0.0387791	64.0177
102	10.100	17684.609	0.5096223	-0.0147193	63.8132
103	10.200	17684.595	0.5026757	-0.0201937	63.2109
104	10.300	17684.581	0.5038864	-0.0251821	62.8110
105	10.400	17684.566	0.5001867	-0.0298772	62.4137
106	10.500	17684.552	0.4963478	-0.0338638	62.0195
107	10.600	17684.537	0.4922283	-0.0372177	61.6284
108	10.700	17684.523	0.4878451	-0.0402191	61.2408
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110	10.900	17684.494	0.4783524	-0.0452886	60.4772
111	11.000	17684.480	0.4733037	-0.0472691	60.1017
112	11.100	17684.466	0.4680738	-0.0489793	59.7310
113	11.200	17684.451	0.4626840	-0.0504691	59.3652
114	11.300	17684.437	0.4570896	-0.0517902	59.0047
115	11.400	17684.422	0.4513549	-0.0529424	58.6499
116	11.500	17684.408	0.4454682	-0.0540221	58.3011
117	11.600	17684.394	0.4393801	-0.0552211	57.9585
118	11.700	17684.379	0.4331438	-0.0563256	57.6225
119	11.800	17684.365	0.4267361	-0.0574663	57.2937
120	11.900	17684.350	0.4201367	-0.0586605	56.9712
121	12.000	17684.336	0.4134439	-0.0599292	56.6564
122	12.100	17684.322	0.4065591	-0.0612785	56.3490
123	12.200	17684.307	0.3994881	-0.0627100	56.0496
124	12.300	17684.293	0.3920462	-0.0642189	55.7575
125	12.400	17684.278	0.3845778	-0.0657951	55.4735
126	12.500	17684.264	0.3769661	-0.0674260	55.1977
127	12.600	17684.250	0.3691819	-0.0690876	54.9300
128	12.700	17684.235	0.3612108	-0.0707659	54.6705
129	12.800	17684.221	0.3531.26	-0.0724372	54.4194
130	12.900	17684.206	0.3449288	-0.0740803	54.1766
131	13.000	17684.192	0.3366135	-0.0756746	53.9423
132	13.100	17684.178	0.3282009	-0.0772018	53.7165
133	13.200	17684.163	0.3197028	-0.0786459	53.4993
134	13.300	17684.149	0.3111356	-0.0799945	53.2907
135	13.400	17684.135	0.3025089	-0.0812390	53.0908
136	13.500	17684.120	0.2938260	-0.0823746	52.8996
137	13.600	17684.106	0.2851.03	-0.0834008	52.7172
138	13.700	17684.091	0.2763758	-0.0843208	52.5437
139	13.800	17684.077	0.2676031	-0.0851416	52.3791
140	13.900	17684.063	0.2588077	-0.0858731	52.2234
141	14.000	17684.048	0.2498898	-0.0865278	52.0768
142	14.100	17684.034	0.2411.77	-0.0871200	51.9393
143	14.200	17684.019	0.2322791	-0.0876650	51.8110
144	14.320	17684.005	0.2233793	-0.0881785	51.6918
145	14.400	17683.991	0.2144648	-0.0886754	51.5820
146	14.500	17683.976	0.2054984	-0.0891095	51.4815
147	14.600	17683.962	0.1964218	-0.0894725	51.3904
148	14.700	17683.947	0.1873660	-0.0901938	51.3087
149	14.800	17683.933	0.1781924	-0.0907396	51.2365
150	14.900	17683.919	0.1689716	-0.0913129	51.1739
151	15.000	17683.904	0.1596764	-0.0918126	51.1209
152	15.100	17683.890	0.1503.03	-0.0923380	51.0774
153	15.200	17683.875	0.1408365	-0.0931794	51.0438
154	15.300	17683.861	0.1312.69	-0.0938483	51.0193
155	15.400	17683.847	0.1217264	-0.0944730	51.0047
156	15.500	17683.832	0.1120911	-0.0950999	50.9998
157	15.600	17683.818	0.1023137	-0.0956487	51.0046
158	15.700	17683.804	0.0924622	-0.0962625	51.0189
159	15.800	17683.789	0.0824880	-0.0967290	51.0429
160	15.900	17683.775	0.0724335	-0.0971612	51.0765
161	16.000	17683.760	0.0624700	-0.0974677	51.1197
162	16.100	17683.746	0.0524479	-0.0977000	51.1724
163	16.220	17683.732	0.0423716	-0.0978482	51.2346
164	16.300	17683.717	0.0321659	-0.0978620	51.3063
165	16.400	17683.703	0.0219797	-0.0977903	51.3874
166	16.500	17683.688	0.0116222	-0.0976220	51.4779
167	16.600	17683.674	0.0012089	-0.0973669	51.5776
168	16.700	17683.660	-0.0091716	-0.0970304	51.6866
169	16.800	17683.645	-0.0195895	-0.0966321	51.8049
170	16.900	17683.631	-0.0300367	-0.0961867	51.9322
171	17.000	17683.616	-0.0405243	-0.0957080	52.0686
172	17.100	17683.602	-0.0509771	-0.0952163	52.2139
173	17.200	17683.588	-0.0613316	-0.0947273	52.3682
174	17.300	17683.573	-0.0717863	-0.0942561	52.5313
175	17.400	17683.559	-0.0821227	-0.0938154	52.7032
176	17.500	17683.544	-0.0926247	-0.0934147	52.8837
177	17.600	17683.530	-0.1029960	-0.0930593	53.0728
178	17.700	17683.516	-0.1013317	-0.0927499	53.2703
179	17.800	17683.501	-0.1100403	-0.0926421	53.4762
180	17.900	17683.487	-0.1199195	-0.0922459	53.6902
181	18.000	17683.473	-0.1291.88	-0.0920182	53.9125
182	18.100	17683.458	-0.1387762	-0.0918021	54.1428
183	18.200	17683.444	-0.1478345	-0.0915481	54.3808
184	18.300	17683.429	-0.1568446	-0.0912161	54.6262
185	18.400	17683.415	-0.1658752	-0.0908248	54.8794
186	18.500	17683.401	-0.1748124	-0.0902899	55.1398
187	18.600	17683.386	-0.1836441	-0.0898859	55.4074
188	18.700	17683.372	-0.1924110	-0.0896771	55.6819
189	18.800	17683.357	-0.2008161	-0.0875269	55.9631
190	18.900	17683.343	-0.2089169	-0.0841000	56.2508
191	19.000	17683.329	-0.2169784	-0.0843682	56.5447
192	19.100	17683.314	-0.2247880	-0.0823035	56.8447
193	19.200	17683.300	-0.2326424	-0.0799867	57.1504
194	19.300	17683.285	-0.2394729	-0.0771048	57.4616
195	19.400	17683.271	-0.2460119	-0.0730325	57.7780
196	19.500	17683.257	-0.2524042	-0.0706324	58.0994
197	19.600	17683.242	-0.2586380	-0.0665053	58.4253
198	19.700	17683.228	-0.2647.16	-0.0624402	58.7557
199	19.800	17683.213	-0.2705.36	-0.0578142	59.0900
200	19.900	17683.199	-0.2730128	-0.0530114	59.4281
201	20.000	17683.185	-0.2706521	-0.0479726	59.7695
202	20.100	17683.170	-0.2801419	-0.0427639	60.1139
203	20.200	17683.156	-0.2862788	-0.0373758	60.4610
204	20.300	17683.142	-0.2880586	-0.0319216	60.8103
205	20.400	17683.127	-0.2866675	-0.0266360	61.1616
206	20.500	17683.113	-0.2877793	-0.0209739	61.5143
207	20.600	17683.098	-0.2881478	-0.0155886	61.8681
208	20.700	17683.084	-0.2885148	-0.0103303	62.2229
209	20.800	17683.070	-0.287.000	-0.0052655	62.5772
210	20.900	17683.055	-0.2871308	-0.0003750	62.9317
211	21.000	17683.041	-0.2858401	0.0042863	63.2856
212	21.100	17683.026	-0.2841579	0.0085905	63.6383
213	21.200	17683.012	-0.2821186	0.0126373	63.9896
214	21.300	17682.998	-0.2797491	0.0163737	64.3391
215	21.400	17682.983	-0.2770876	0.0197963	64.6862
216	21.500	17682.969	-0.2741067	0.0229009	65.0306
217	21.600	17682.954	-0.2710096	0.0257020	65.3721
218	21.700	17682.940	-0.2676540	0.0282119	65.7102
219	21.800	17682.926	-0.2641130	0.0304501	66.0446
220	21.900	17682.911	-0.2604169	0.0324398	66.3750
221	22.000	17682.897	-0.2565911	0.0342072	66.7013
222	22.100	17682.882	-0.2526424	0.0357799	67.0231
223	22.200	17682.868	-0.2485910	0.0371863	67.3404
224	22.300	17682.854	-0.2444449	0.0384537	67.6528
225	22.400	17682.839	-0.2402138	0.0396081	67.9603

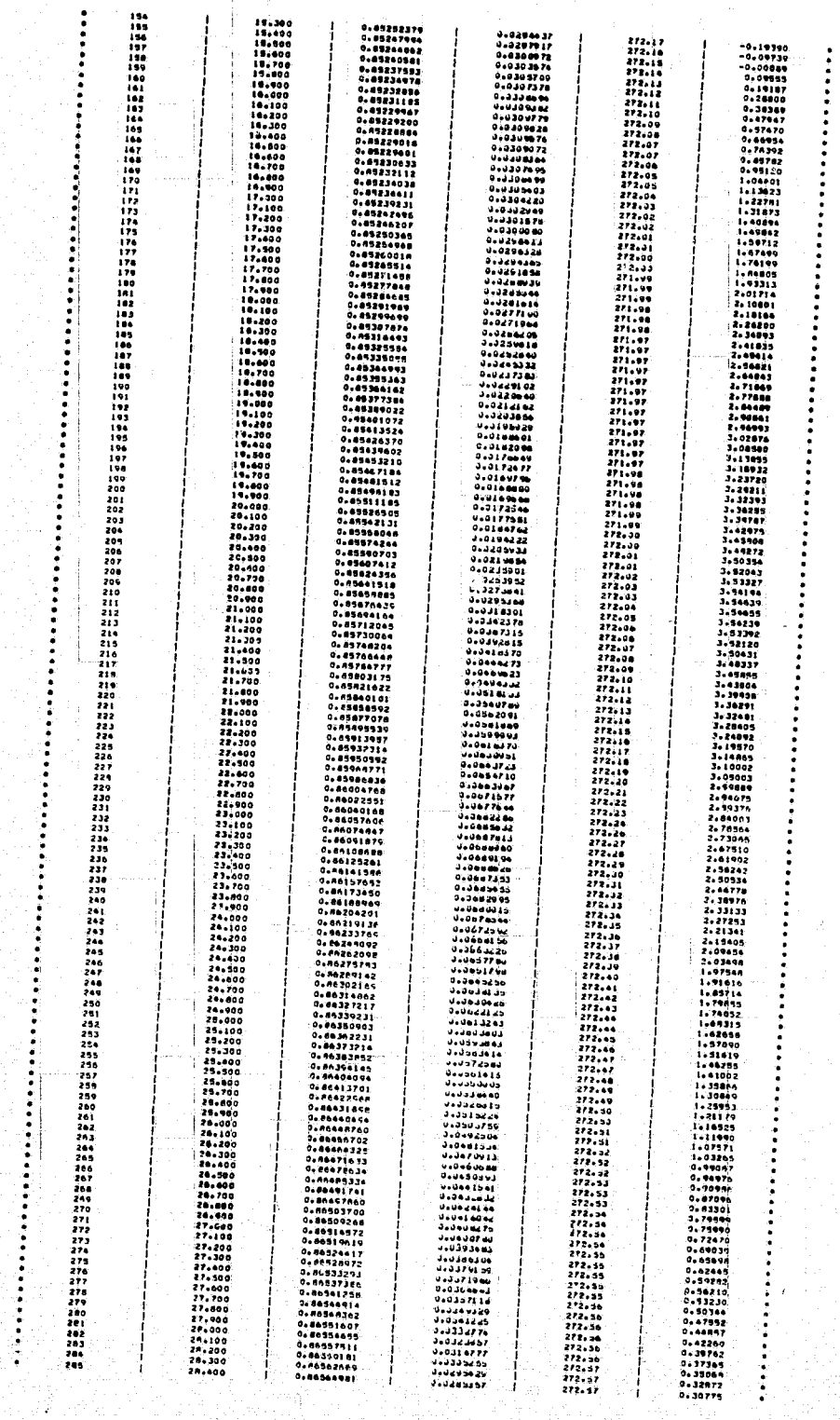
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226	22.500	17662.825	-0.2399038	0.0406727	68.3828
227	22.600	17662.811	-0.2318196	0.0416673	68.9801
228	22.700	17662.796	-0.2270838	0.0428081	69.6821
229	22.800	17662.782	-0.2225368	0.0435068	69.1388
230	22.900	17662.767	-0.2179466	0.0443712	69.4201
231	23.000	17662.753	-0.2132858	0.0452062	69.6999
232	23.100	17662.739	-0.2083260	0.0460881	69.9682
233	23.200	17662.724	-0.2037619	0.0467696	70.2299
234	23.300	17662.710	-0.1989068	0.0476903	70.4900
235	23.400	17662.695	-0.1939907	0.0481573	70.7434
236	23.500	17662.681	-0.1898203	0.0487595	70.9910
237	23.600	17662.667	-0.1848904	0.0492849	71.2329
238	23.700	17662.652	-0.1795280	0.0497215	71.4699
239	23.800	17662.638	-0.1738409	0.0500582	71.6992
240	23.900	17662.623	-0.1687181	0.0502855	71.9235
241	24.000	17662.609	-0.1635795	0.0503960	72.1419
242	24.100	17662.595	-0.1584365	0.0503681	72.3543
243	24.200	17662.580	-0.1532968	0.0502868	72.5606
244	24.300	17662.565	-0.1481762	0.0499966	72.7613
245	24.400	17662.551	-0.1430786	0.0496216	72.9559
246	24.500	17662.537	-0.1380200	0.0491385	73.1446
247	24.600	17662.523	-0.1330079	0.0485863	73.3273
248	24.700	17662.508	-0.1280510	0.0478877	73.5043
249	24.800	17662.494	-0.1231587	0.0471672	73.6754
250	24.900	17662.480	-0.1183314	0.0463208	73.8409
251	25.000	17662.465	-0.1135801	0.0455142	74.0008
252	25.100	17662.451	-0.1089067	0.0446848	74.1551
253	25.200	17662.436	-0.1042137	0.0437872	74.3041
254	25.300	17662.422	-0.0998025	0.0429263	74.4477
255	25.400	17662.408	-0.0953739	0.0420882	74.5861
256	25.500	17662.393	-0.0910284	0.0412780	74.7196
257	25.600	17662.379	-0.0867681	0.0404840	74.8478
258	25.700	17662.364	-0.0825731	0.0397877	74.9714
259	25.800	17662.350	-0.0784639	0.0390836	75.0902
260	25.900	17662.336	-0.0744308	0.0384103	75.2048
261	26.000	17662.321	-0.0704726	0.0377938	75.3142
262	26.100	17662.307	-0.0665883	0.0372074	75.4197
263	26.200	17662.292	-0.0627777	0.0366426	75.5208
264	26.300	17662.278	-0.0590411	0.0360853	75.6178
265	26.400	17662.264	-0.0553799	0.0355362	75.7109
266	26.500	17662.249	-0.0517980	0.0349720	75.7998
267	26.600	17662.238	-0.0482963	0.0343851	75.8850
268	26.700	17662.228	-0.0448726	0.0337647	75.9665
269	26.800	17662.206	-0.0415406	0.0331012	76.0442
270	26.900	17662.192	-0.0382015	0.0323867	76.1185
271	27.000	17662.177	-0.0351404	0.0316153	76.1892
272	27.100	17662.163	-0.0321223	0.0307833	76.2566
273	27.200	17662.149	-0.0291984	0.0298898	76.3205
274	27.300	17662.134	-0.0263736	0.0289351	76.3815
275	27.400	17662.120	-0.0236766	0.0279239	76.4392
276	27.500	17662.105	-0.0210986	0.0268619	76.4939
277	27.600	17662.091	-0.0186447	0.0257570	76.5457
278	27.700	17662.077	-0.0163166	0.0246190	76.5947
279	27.800	17662.062	-0.0141151	0.0234589	76.6409
280	27.900	17662.048	-0.0120386	0.0222868	76.6844
281	28.000	17662.033	-0.0100863	0.0211210	76.7254
282	28.100	17662.019	-0.0082582	0.0199679	76.7640
283	28.200	17662.005	-0.0065651	0.0188614	76.8002
284	28.300	17661.990	-0.0049437	0.0177528	76.8342
285	28.400	17661.976	-0.0034477	0.0167113	76.8660
286	28.500	17661.961	-0.0020901	0.0157256	76.8957
287	28.600	17661.947	-0.0007431	0.0148021	76.9235
288	28.700	17661.933	0.0004613	0.0139654	76.9495
289	28.800	17661.918	0.0016315	0.0131978	76.9737
290	28.900	17661.904	0.0027158	0.0124958	76.9962
291	29.000	17661.889	0.0037417	0.0117998	77.0172
292	29.100	17661.875	0.0047170	0.0112044	77.0366
293	29.200	17661.861	0.0056482	0.0106786	77.0546
294	29.300	17661.846	0.0065412	0.0102056	77.0713
295	29.400	17661.832	0.0074084	0.0097779	77.0867
296	29.500	17661.816	0.0082298	0.0093866	77.1008
297	29.600	17661.803	0.0090310	0.0090228	77.1138
298	29.700	17661.789	0.0098051	0.0086763	77.1258
299	29.800	17661.774	0.0105516	0.0083381	77.1367
300	29.900	17661.759	0.0112686	0.0079987	77.1467
301	30.000	17661.746	0.0119530	0.0076496	77.1558
302	30.100	17661.731	0.0126007	0.0072827	77.1641
303	30.200	17661.717	0.0132066	0.0068913	77.1717
304	30.300	17661.702	0.0137648	0.0064697	77.1786
305	30.400	17661.688	0.0142691	0.0060137	77.1848
306	30.500	17661.674	0.0147128	0.0055288	77.1905
307	30.600	17661.659	0.0150835	0.0049893	77.1957
308	30.700	17661.645	0.0153929	0.0044203	77.2005
309	30.800	17661.630	0.0156178	0.0038161	77.2048
310	30.900	17661.616	0.0157590	0.0031807	77.2089
311	31.000	17661.602	0.0158138	0.0025208	77.2126
312	31.100	17661.587	0.0157801	0.0018614	77.2162
313	31.200	17661.573	0.0156879	0.0011539	77.2196
314	31.300	17661.558	0.0154460	0.0004682	77.2229
315	31.400	17661.544	0.0151573	-0.0002039	77.2261
316	31.500	17661.530	0.0147491	-0.0008498	77.2293
317	31.600	17661.515	0.0143526	-0.0014557	77.2326
318	31.700	17661.501	0.0138584	-0.0020076	77.2359
319	31.800	17661.487	0.0133191	-0.0024914	77.2391
320	31.900	17661.472	0.0127491	-0.0028934	77.2418
321	32.000	17661.458	0.0121665	-0.0032006	77.2440
322	32.100	17661.443	0.0115847	-0.0034012	77.2504
323	32.200	17661.429	0.0110221	-0.0034855	77.2545
324	32.300	17661.415	0.0105009	-0.0034452	77.2588
325	32.400	17661.400	0.0100381	-0.0032773	77.2634
326	32.500	17661.386	0.0096514	-0.0029784	77.2681
327	32.600	17661.371	0.0093560	-0.0025611	77.2730
328	32.700	17661.357	0.0091723	-0.0020513	77.2781
329	32.800	17661.343	0.0091072	-0.0013393	77.2833

DATA POINT	TIME (SECS)	DENSITY (KG/M**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-K)	ACCELERATION (M/SEC**2)
1	0.0	0.869548672	0.0102852	272.91	0.06814
2	0.100	0.869541719	0.0098839	272.93	0.06807
3	0.200	0.869535318	0.0092223	272.94	0.06719
4	0.300	0.869528866	0.0088823	272.96	0.06677
5	0.400	0.869522363	0.0084197	272.97	0.06687
6	0.500	0.869516890	0.0080960	272.99	0.06838
7	0.600	0.869507301	0.0084923	273.01	0.06832
8	0.700	0.869497543	0.0086807	273.02	0.06970
9	0.800	0.869497833	0.0088133	273.04	0.06987
10	0.900	0.869488078	0.0091174	273.05	0.05299
11	1.000	0.869485276	0.0094973	273.07	0.04693
12	1.100	0.869484210	0.0099363	273.08	0.04456
13	1.200	0.869480832	0.0104073	273.10	0.03993
14	1.300	0.869480686	0.0109836	273.11	0.03512
15	1.400	0.869480647	0.0113698	273.13	0.03023
16	1.500	0.869480660	0.0118111	273.14	0.02536
17	1.600	0.869480640	0.0121958	273.16	0.02061
18	1.700	0.869480617	0.0123813	273.17	0.01608
19	1.800	0.869480571	0.0123798	273.18	0.01187
20	1.900	0.869480519	0.0122832	273.19	0.00807
21	2.000	0.869480482	0.0119770	273.21	0.00472

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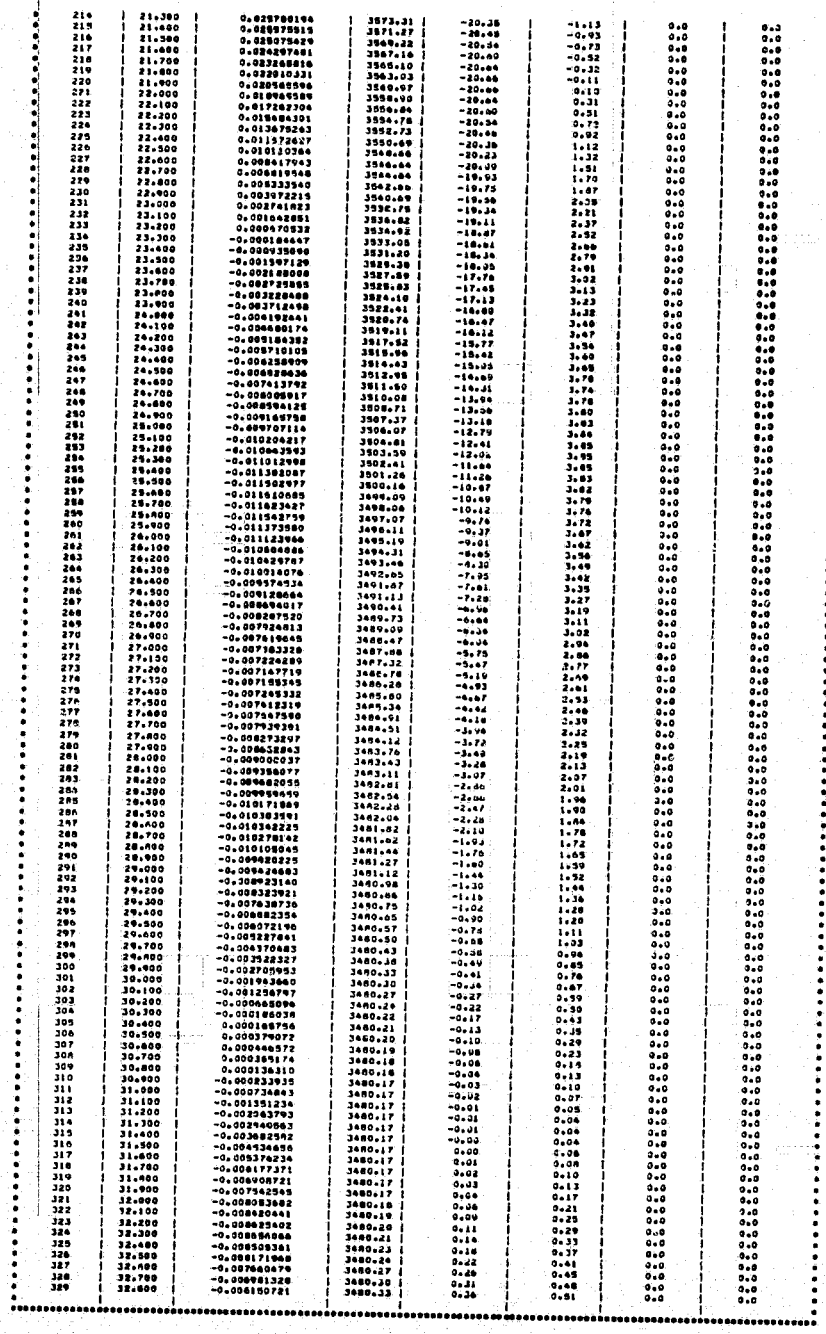


286	28.500	0.86567122	0.027[illegible]12	272.87	0.28777
287	28.600	0.86569099	0.026[illegible]86	272.87	0.26876
288	28.700	0.86572914	0.025[illegible]82	272.88	0.25067
289	28.800	0.86578574	0.024[illegible]81	272.88	0.23350
290	28.900	0.86576088	0.023[illegible]89	272.88	0.21728
291	29.000	0.86579456	0.022[illegible]06	272.89	0.20173
292	29.100	0.86578688	0.021[illegible]78	272.89	0.18707
293	29.200	0.86577791	0.020[illegible]64	272.89	0.17314
294	29.300	0.86578771	0.019[illegible]56	272.90	0.16003
295	29.400	0.86579636	0.019[illegible]91	272.90	0.14758
296	29.500	0.86580392	0.018[illegible]10	272.91	0.13583
297	29.600	0.86581048	0.017[illegible]56	272.91	0.12475
298	29.700	0.86581611	0.017[illegible]08	272.92	0.11433
299	29.800	0.86582090	0.016[illegible]16	272.92	0.10456
300	29.900	0.86582493	0.015[illegible]03	272.93	0.09545
301	30.000	0.86582827	0.015[illegible]04	272.94	0.08699
302	30.100	0.86583100	0.014[illegible]90	272.94	0.07918
303	30.200	0.86583321	0.013[illegible]38	272.95	0.07201
304	30.300	0.86583497	0.013[illegible]21	272.96	0.06544
305	30.400	0.86583636	0.012[illegible]26	272.97	0.05946
306	30.500	0.86583739	0.012[illegible]09	272.98	0.05430
307	30.600	0.86583818	0.012[illegible]63	272.99	0.04963
308	30.700	0.86583877	0.012[illegible]81	273.00	0.04558
309	30.800	0.86583920	0.012[illegible]16	273.01	0.04206
310	30.900	0.86583951	0.012[illegible]77	273.02	0.03906
311	31.000	0.86583973	0.012[illegible]03	273.03	0.03647
312	31.100	0.86583986	0.012[illegible]6v	273.04	0.03477
313	31.200	0.86583992	0.012[illegible]68	273.05	0.03338
314	31.300	0.86584008	0.012[illegible]17	273.06	0.03249
315	31.400	0.86584012	0.012[illegible]83	273.07	0.03218
316	31.500	0.86584013	0.012[illegible]65	273.08	0.03209
317	31.600	0.86584008	0.012[illegible]88	273.09	0.03256
318	31.700	0.86583997	0.012[illegible]86	273.10	0.03343
319	31.800	0.86583976	0.012[illegible]56	273.11	0.03496
320	31.900	0.86583943	0.012[illegible]21	273.12	0.03621
321	32.000	0.86583895	0.012[illegible]12	273.13	0.03802
322	32.100	0.86583829	0.012[illegible]62	273.14	0.04003
323	32.200	0.86583740	0.012[illegible]25	273.15	0.04215
324	32.300	0.86583626	0.012[illegible]89	273.16	0.04430
325	32.400	0.86583482	0.012[illegible]73	273.17	0.04628
326	32.500	0.86583305	0.012[illegible]20	273.18	0.04832
327	32.600	0.86583090	0.012[illegible]89	273.19	0.05002
328	32.700	0.86582836	0.012[illegible]55	273.20	0.05140
329	32.800	0.86582539	0.012[illegible]77	273.21	0.05238

DATA POINT	TIME (SECS)	ANGLE-OF-ATTACK RATE (RADIAN/SEC)	ALTITUDE (METERS)	ALTITUDE RATE (M/SEC)	ALT. ACCEL. (M/SEC**2)	VERT. ACCEL. (M/SEC**2)	ELEV. DEFLECT. (RADIANS)
1	0.0	-0.000[illegible]8038	3439.15	-0.76	0.81	0.0	0.0
2	0.100	-0.009[illegible]0949	3439.08	-0.89	0.34	0.0	0.0
3	0.200	+0.004[illegible]70505	3439.01	-0.84	0.56	0.0	0.0
4	0.300	+0.[illegible]3019986J	3438.93	-0.58	0.57	0.0	0.0
5	0.400	+0.001[illegible]7026	3438.89	-0.52	0.59	0.0	0.0
6	0.500	-0.000[illegible]1457	3438.84	-0.46	0.58	0.0	0.0
7	0.600	0.[illegible]0531064	3438.80	-0.41	0.57	0.0	0.0
8	0.700	0.001[illegible]3047	3438.76	-0.43	0.56	0.0	0.0
9	0.800	0.[illegible]2607294	3438.73	-0.49	0.56	0.0	0.0
10	0.900	0.[illegible]3449238	3438.70	-0.24	0.52	0.0	0.0
11	1.000	0.004[illegible]7511	3438.68	-0.19	0.49	0.0	0.0
12	1.100	0.004[illegible]6681	3438.67	-0.16	0.48	0.0	0.0
13	1.200	0.004[illegible]5644	3438.65	-0.10	0.41	0.0	0.0
14	1.300	0.004[illegible]0714	3438.65	-0.06	0.35	0.0	0.0
15	1.400	0.004[illegible]7021	3438.64	-0.03	0.32	0.0	0.0
16	1.500	0.004[illegible]7030	3438.64	0.00	0.27	0.0	0.0
17	1.600	0.[illegible]3884658	3438.64	0.02	0.22	0.0	0.0
18	1.700	0.002[illegible]5183	3438.64	0.04	0.17	0.0	0.0
19	1.800	0.001[illegible]5586	3438.65	0.06	0.12	0.0	0.0
20	1.900	0.000[illegible]1418	3438.66	0.07	0.07	0.0	0.0
21	2.000	-0.000[illegible]6703	3438.66	0.07	0.03	0.0	0.0
22	2.100	-0.002[illegible]0869	3438.67	0.07	-0.00	0.0	0.0
23	2.200	-0.[illegible]3536557	3438.68	0.07	-0.03	0.0	0.0
24	2.300	-0.004[illegible]0126	3438.68	0.07	-0.04	0.0	0.0
25	2.400	-0.[illegible]3058915	3438.69	0.06	-0.05	0.0	0.0
26	2.500	-0.006[illegible]4349	3438.70	0.06	-0.06	0.0	0.0
27	2.600	-0.007[illegible]3812	3438.70	0.06	-0.06	0.0	0.0
28	2.700	-0.007[illegible]5587	3438.71	0.06	0.01	0.0	0.0
29	2.800	-0.007[illegible]5562	3438.71	0.06	0.08	0.0	0.0
30	2.900	-0.007[illegible]6537	3438.72	0.07	0.13	0.0	0.0
31	3.000	-0.006[illegible]9650	3438.73	0.09	0.21	0.0	0.0
32	3.100	-0.[illegible]3851[illegible]862	3438.76	0.11	0.31	0.0	0.0
33	3.200	-0.[illegible]3600[illegible]387	3438.79	0.15	0.43	0.0	0.0
34	3.300	-0.002[illegible]2942	3438.77	0.20	0.56	0.0	0.0
35	3.400	0.[illegible]1121602	3438.79	0.26	0.71	0.0	0.0
36	3.500	0.002[illegible]6718	3438.82	0.34	0.88	0.0	0.0
37	3.600	0.005[illegible]8445	3438.86	0.44	1.08	0.0	0.0
38	3.700	0.[illegible]9562289	3438.91	0.55	1.29	0.0	0.0
39	3.800	0.011[illegible]3614	3438.97	0.69	1.47	0.0	0.0
40	3.900	0.015[illegible]3268	3439.05	0.83	1.69	0.0	0.0
41	4.000	0.[illegible]8856818	3439.14	1.03	1.93	0.0	0.0
42	4.100	0.021[illegible]1178	3439.26	1.26	2.17	0.0	0.0
43	4.200	0.025[illegible]8107	3439.39	1.48	2.42	0.0	0.0
44	4.300	0.[illegible]8236763	3439.55	1.72	2.67	0.0	0.0
45	4.400	0.031[illegible]6477	3439.74	2.00	2.93	0.0	0.0
46	4.500	0.033[illegible]0750	3439.95	2.31	3.19	0.0	0.0
47	4.600	0.[illegible]3568157	3440.20	2.66	3.46	0.0	0.0
48	4.700	0.037[illegible]0501	3440.48	3.00	3.72	0.0	0.0
49	4.800	0.[illegible]8620127	3440.80	3.38	3.97	0.0	0.0
50	4.900	0.[illegible]9151959	3441.16	3.79	4.23	0.0	0.0
51	5.000	0.[illegible]3965082	3441.56	4.23	4.48	0.0	0.0
52	5.100	0.[illegible]9271316	3442.00	4.69	4.72	0.0	0.0
53	5.200	0.[illegible]8741395	3442.44	5.17	4.95	0.0	0.0
54	5.300	0.[illegible]7209811	3443.06	5.68	5.17	0.0	0.0
55	5.400	0.[illegible]9526343	3443.63	6.20	5.38	0.0	0.0
56	5.500	0.[illegible]3376823	3444.28	6.75	5.59	0.0	0.0
57	5.600	0.[illegible]4E030	3444.98	7.32	5.77	0.0	0.0
58	5.700	0.[illegible]4984962	3445.74	7.91	5.96	0.0	0.0
59	5.800	0.[illegible]5945603	3446.56	8.51	6.10	0.0	0.0
60	5.900	0.[illegible]3258370	3447.45	9.13	6.25	0.0	0.0
61	6.000	0.[illegible]8208197	3448.36	9.75	6.34	0.0	0.0
62	6.100	0.[illegible]3A989	3449.40	10.40	6.48	0.0	0.0
63	6.200	0.[illegible]9789783	3450.47	11.06	6.59	0.0	0.0
64	6.300	0.[illegible]3462578	3451.61	11.74	6.67	0.0	0.0
65	6.400	0.[illegible]2192211	3452.81	12.46	6.76	0.0	0.0
66	6.500	0.[illegible]0861834	3454.09	13.21	6.78	0.0	0.0
67	6.600	0.[illegible]4947861	3455.43	13.96	6.82	0.0	0.0
68	6.700	0.[illegible]3938678	3456.83	14.73	6.83	0.0	0.0
69	6.800	0.[illegible]4E660	3458.31	15.51	6.92	0.0	0.0
70	6.900	0.[illegible]4096	3459.86	16.29	6.90	0.0	0.0
71	7.000	0.[illegible]5675	3461.47	17.07	6.73	0.0	0.0
72	7.100	0.[illegible]3473	3463.15	17.86	6.63	0.0	0.0
73	7.200	0.[illegible]8190	3464.90	18.61	6.41	0.0	0.0
74	7.300	0.[illegible]0462	3466.71	19.38	6.31	0.0	[illegible]
75	7.400	0.[illegible]7780	3468.59	20.11	6.10	0.0	[illegible]
76	7.500	0.[illegible]5239	3470.53	20.74	6.26	0.0	[illegible]
77	7.600	0.[illegible]9239	3472.56	20.46	6.10	0.0	[illegible]
78	7.700	0.[illegible]0213	3474.60	20.90	5.91	0.0	[illegible]
79	7.800	0.[illegible]0071	3476.73	21.38	5.74	0.0	0.0
80	7.900	0.[illegible]6536	3478.91	22.11	5.56	0.0	0.0
81	8.000	0.[illegible]6398	3481.19	22.85	5.32	0.0	0.0

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82	8.100	0.011447390	3683.44	23.17	9.09	0.0	0.0	0.0	0.0
83	8.200	0.009560263	3688.78	23.07	9.84	0.0	0.0	0.0	0.0
84	8.300	0.007176092	3688.17	24.14	4.89	0.0	0.0	0.0	0.0
85	8.400	0.004316795	3690.81	24.48	4.32	0.0	0.0	0.0	0.0
86	8.500	0.001016116	3693.09	25.00	4.05	0.0	0.0	0.0	0.0
87	8.600	-0.002644213	3695.61	25.39	3.77	0.0	0.0	0.0	0.0
88	8.700	-0.006456458	3698.17	25.76	3.48	0.0	0.0	0.0	0.0
89	8.800	-0.010860222	3500.76	26.09	3.19	0.0	0.0	0.0	0.0
90	8.900	-0.015207863	3503.38	26.39	2.89	0.0	0.0	0.0	0.0
91	9.000	-0.019868198	3506.06	26.67	2.59	0.0	0.0	0.0	0.0
92	9.100	-0.023844476	3508.72	26.91	2.29	0.0	0.0	0.0	0.0
93	9.200	-0.027931625	3511.42	27.13	1.98	0.0	0.0	0.0	0.0
94	9.300	-0.031730186	3514.16	27.31	1.68	0.0	0.0	0.0	0.0
95	9.400	-0.035149856	3516.88	27.46	1.37	0.0	0.0	0.0	0.0
96	9.500	-0.038112966	3519.63	27.58	1.07	0.0	0.0	0.0	0.0
97	9.600	-0.040559626	3522.39	27.68	0.76	0.0	0.0	0.0	0.0
98	9.700	-0.042632181	3525.17	27.76	0.46	0.0	0.0	0.0	0.0
99	9.800	-0.043713458	3527.96	27.77	0.16	0.0	0.0	0.0	0.0
100	9.900	-0.044388233	3530.72	27.77	-0.14	0.0	0.0	0.0	0.0
101	10.000	-0.044462168	3533.49	27.76	-0.44	0.0	0.0	0.0	0.0
102	10.100	-0.043957461	3536.26	27.68	-0.74	0.0	0.0	0.0	0.0
103	10.200	-0.042909272	3539.03	27.59	-1.03	0.0	0.0	0.0	0.0
104	10.300	-0.041368387	3541.78	27.47	-1.32	0.0	0.0	0.0	0.0
105	10.400	-0.039382941	3544.52	27.32	-1.61	0.0	0.0	0.0	0.0
106	10.500	-0.037026258	3547.25	27.15	-1.89	0.0	0.0	0.0	0.0
107	10.600	-0.034384228	3549.95	26.95	-2.18	0.0	0.0	0.0	0.0
108	10.700	-0.031668232	3552.63	26.72	-2.45	0.0	0.0	0.0	0.0
109	10.800	-0.028809868	3555.29	26.46	-2.69	0.0	0.0	0.0	0.0
110	10.900	-0.025294889	3557.93	26.18	-2.93	0.0	0.0	0.0	0.0
111	11.000	-0.022063773	3560.53	25.86	-3.17	0.0	0.0	0.0	0.0
112	11.100	-0.018948184	3563.10	25.55	-3.40	0.0	0.0	0.0	0.0
113	11.200	-0.015980393	3565.64	25.20	-3.61	0.0	0.0	0.0	0.0
114	11.300	-0.012990457	3568.14	24.83	-3.81	0.0	0.0	0.0	0.0
115	11.400	-0.010288103	3570.60	24.43	-4.00	0.0	0.0	0.0	0.0
116	11.500	-0.007792197	3572.03	24.03	-4.17	0.0	0.0	0.0	0.0
117	11.600	-0.005547416	3575.41	23.60	-4.33	0.0	0.0	0.0	0.0
118	11.700	-0.003569076	3577.75	23.16	-4.48	0.0	0.0	0.0	0.0
119	11.800	-0.001987182	3580.06	22.71	-4.60	0.0	0.0	0.0	0.0
120	11.900	-0.000443653	3582.29	22.26	-4.72	0.0	0.0	0.0	0.0
121	12.000	0.000707272	3584.49	21.76	-4.82	0.0	0.0	0.0	0.0
122	12.100	0.001598600	3586.64	21.28	-4.90	0.0	0.0	0.0	0.0
123	12.200	0.002248789	3588.74	20.78	-4.97	0.0	0.0	0.0	0.0
124	12.300	0.002682765	3590.79	20.28	-5.02	0.0	0.0	0.0	0.0
125	12.400	0.002888814	3592.80	19.78	-5.07	0.0	0.0	0.0	0.0
126	12.500	0.003018358	3594.75	19.27	-5.10	0.0	0.0	0.0	0.0
127	12.600	0.002984465	3596.65	18.76	-5.12	0.0	0.0	0.0	0.0
128	12.700	0.002960888	3598.50	18.25	-5.13	0.0	0.0	0.0	0.0
129	12.800	0.002579291	3600.30	17.73	-5.14	0.0	0.0	0.0	0.0
130	12.900	0.002471118	3602.05	17.22	-5.13	0.0	0.0	0.0	0.0
131	13.000	0.002263572	3603.76	16.71	-5.12	0.0	0.0	0.0	0.0
132	13.100	0.002380291	3605.39	16.19	-5.11	0.0	0.0	0.0	0.0
133	13.200	0.001948402	3606.98	15.66	-5.09	0.0	0.0	0.0	0.0
134	13.300	0.001958135	3608.53	15.16	-5.07	0.0	0.0	0.0	0.0
135	13.400	0.001842613	3610.02	14.67	-5.05	0.0	0.0	0.0	0.0
136	13.500	0.001497901	3611.46	14.17	-5.03	0.0	0.0	0.0	0.0
137	13.600	0.000283237	3612.85	13.68	-5.01	0.0	0.0	0.0	0.0
138	13.700	0.000213481	3614.19	13.16	-5.00	0.0	0.0	0.0	0.0
139	13.800	0.000289533	3615.49	12.65	-4.98	0.0	0.0	0.0	0.0
140	13.900	0.000274321	3616.73	12.17	-4.97	0.0	0.0	0.0	0.0
141	14.000	0.000306878	3617.92	11.67	-4.96	0.0	0.0	0.0	0.0
142	14.100	0.000300309	3619.06	11.17	-4.96	0.0	0.0	0.0	0.0
143	14.200	0.000372611	3620.15	10.68	-4.95	0.0	0.0	0.0	0.0
144	14.300	0.000386404	3621.20	10.18	-4.96	0.0	0.0	0.0	0.0
145	14.400	0.000408185	3622.19	9.69	-4.96	0.0	0.0	0.0	0.0
146	14.500	0.000529435	3623.13	9.19	-4.97	0.0	0.0	0.0	0.0
147	14.600	0.000488337	3624.03	8.69	-4.98	0.0	0.0	0.0	0.0
148	14.700	0.000477514	3624.87	8.20	-4.99	0.0	0.0	0.0	0.0
149	14.800	0.000478098	3625.67	7.70	-5.00	0.0	0.0	0.0	0.0
150	14.900	0.000713895	3626.41	7.20	-5.02	0.0	0.0	0.0	0.0
151	15.000	0.000562508	3627.11	6.69	-5.03	0.0	0.0	0.0	0.0
152	15.100	0.000336683	3627.75	6.19	-5.04	0.0	0.0	0.0	0.0
153	15.200	0.000037232	3628.35	5.69	-5.05	0.0	0.0	0.0	0.0
154	15.300	0.000379629	3628.89	5.18	-5.06	0.0	0.0	0.0	0.0
155	15.400	0.000273521	3629.38	4.67	-5.07	0.0	0.0	0.0	0.0
156	15.500	0.000232192	3625.82	4.16	-5.08	0.0	0.0	0.0	0.0
157	15.600	0.000386496	3630.21	3.66	-5.08	0.0	0.0	0.0	0.0
158	15.700	0.000900555	3630.55	3.15	-5.09	0.0	0.0	0.0	0.0
159	15.800	0.001438673	3630.84	2.64	-5.09	0.0	0.0	0.0	0.0
160	15.900	0.000956841	3631.08	2.13	-5.08	0.0	0.0	0.0	0.0
161	16.000	0.000584091	3631.27	1.62	-5.08	0.0	0.0	0.0	0.0
162	16.100	0.000215165	3631.41	1.12	-5.07	0.0	0.0	0.0	0.0
163	16.200	-0.000109902	3631.49	0.61	-5.06	0.0	0.0	0.0	0.0
164	16.300	-0.000386046	3631.53	0.0	-5.06	0.0	0.0	0.0	0.0
165	16.400	-0.000613411	3631.51	-0.40	-5.05	0.0	0.0	0.0	0.0
166	16.500	-0.000795140	3631.45	-0.91	-5.04	0.0	0.0	0.0	0.0
167	16.600	-0.000937408	3631.33	-1.41	-5.03	0.0	0.0	0.0	0.0
168	16.700	-0.001049011	3631.17	-1.91	-5.02	0.0	0.0	0.0	0.0
169	16.800	-0.001140942	3630.98	-2.42	-5.02	0.0	0.0	0.0	0.0
170	16.900	-0.001225834	3630.68	-2.92	-5.01	0.0	0.0	0.0	0.0
171	17.000	-0.001317296	3630.37	-3.42	-5.01	0.0	0.0	0.0	0.0
172	17.100	-0.001429190	3630.00	-3.92	-5.01	0.0	0.0	0.0	0.0
173	17.200	-0.001574986	3629.58	-4.42	-5.01	0.0	0.0	0.0	0.0
174	17.300	-0.001766378	3629.12	-4.92	-5.01	0.0	0.0	0.0	0.0
175	17.400	-0.002013716	3628.60	-5.42	-5.01	0.0	0.0	0.0	0.0
176	17.500	-0.002324192	3628.03	-5.92	-5.01	0.0	0.0	0.0	0.0
177	17.600	-0.002716830	3627.41	-6.42	-5.02	0.0	0.0	0.0	0.0
178	17.700	-0.003146159	3626.75	-6.92	-5.02	0.0	0.0	0.0	0.0
179	17.800	-0.003653573	3626.03	-7.42	-5.02	0.0	0.0	0.0	0.0
180	17.900	-0.004219384	3625.26	-7.92	-5.01	0.0	0.0	0.0	0.0
181	18.000	-0.004818733	3624.44	-8.42	-5.01	0.0	0.0	0.0	0.0
182	18.100	-0.005544827	3623.57	-8.92	-4.99	0.0	0.0	0.0	0.0
183	18.200	-0.006078368	3622.66	-9.42	-4.98	0.0	0.0	0.0	0.0
184	18.300	-0.006490037	3621.69	-9.91	-4.96	0.0	0.0	0.0	0.0
185	18.400	-0.007255680	3620.67	-10.42	-4.93	0.0	0.0	0.0	0.0
186	18.500	-0.007746983	3619.60	-10.91	-4.90	0.0	0.0	0.0	0.0
187	18.600	-0.008136381	3618.49	-11.40	-4.88	0.0	0.0	0.0	0.0
188	18.700	-0.008396086	3617.32	-11.88	-4.80	0.0	0.0	0.0	0.0
189	18.800	-0.008500155	3616.11	-12.36	-4.76	0.0	0.0	0.0	0.0
190	18.900	-0.008625313	3614.85	-12.83	-4.67	0.0	0.0	0.0	0.0
191	19.000	-0.008151898	3613.56	-13.26	-4.59	0.0	0.0	0.0	0.0
192	19.100	-0.007664678	3612.19	-13.75	-4.51	0.0	0.0	0.0	0.0
193	19.200	-0.006953546	3610.80	-14.19	-4.41	0.0	0.0	0.0	0.0
194	19.300	-0.006013993	3609.36	-14.63	-4.31	0.0	0.0	0.0	0.0
195	19.400	-0.004847443	3607.87	-15.05	-4.20	0.0	0.0	0.0	0.0
196	19.500	-0.003461370	3606.35	-15.47	-4.08	0.0	0.0	0.0	0.0
197	19.600	-0.001869248	3604.78	-15.87	-3.96	0.0	0.0	0.0	0.0
198	19.700	-0.000090317	3603.17	-16.26	-3.83	0.0	0.0	0.0	0.0
199	19.800	0.001890801	3601.53	-16.63	-3.69	0.0	0.0	0.0	0.0
200	19.900	0.003924622	3599.85	-17.00	-3.55	0.0	0.0	0.0	0.0
201	20.000	0.005897247	3598.13	-17.36	-3.40	0.0	0.0	0.0	0.0
202	20.100	0.008332106	3596.38	-17.68	-3.25	0.0	0.0	0.0	0.0
203	20.200	0.010568800	3594.59	-17.99	-3.08	0.0	0.0	0.0	0.0
204	20.300	0.012826003	3592.78	-18.29	-2.93	0.0	0.0	0.0	0.0
205	20.400	0.015321436	3590.94	-18.58	-2.77	0.0	0.0	0.0	0.0
206	20.500	0.017073092	3589.06	-18.85	-2.60	0.0	0.0	0.0	0.0
207	20.600	0.019080278	3587.17	-19.10	-2.43	0.0	0.0	0.0	0.0
208	20.700	0.229744690	3585.25	-19.33	-2.25	0.0	0.0	0.0	0.0
209	20.800	0.022271458	3583.30	-19.53	-2.07	0.0	0.0	0.0	0.0
210	20.900	0.025550141	3581.36	-19.75	-1.88	0.0	0.0	0.0	0.0
211	21.000	0.024598758	3579.35	-19.92	-1.70	0.0	0.0	0.0	0.0
212	21.100	0.025240404	3577.38	-20.09	-1.51	0.0	0.0	0.0	0.0
213	21.200	0.025675110	3575.34	-20.23	-1.32	0.0	0.0	0.0	0.0



216	21.380	0.029780194	3573.31	-20.28	-1.13	0.0	0.0
217	21.400	0.029875515	3571.27	-20.48	-0.93	0.0	0.0
218	21.500	0.030375279	3569.22	-20.56	-0.73	0.0	0.0
219	21.600	0.030297481	3567.16	-20.60	-0.52	0.0	0.0
220	21.700	0.030288816	3565.10	-20.64	-0.32	0.0	0.0
221	21.800	0.030280331	3563.03	-20.66	-0.11	0.0	0.0
222	21.900	0.030580594	3560.97	-20.66	0.10	0.0	0.0
223	22.000	0.030965589	3558.90	-20.66	0.31	0.0	0.0
224	22.100	0.031282704	3556.84	-20.60	0.51	0.0	0.0
225	22.200	0.031884301	3554.78	-20.54	0.72	0.0	0.0
226	22.300	0.031879263	3552.73	-20.46	0.92	0.0	0.0
227	22.400	0.031572637	3550.69	-20.36	1.12	0.0	0.0
228	22.500	0.031012784	3548.66	-20.23	1.32	0.0	0.0
229	22.600	0.030847943	3546.64	-20.09	1.51	0.0	0.0
230	22.700	0.030819548	3544.64	-19.93	1.70	0.0	0.0
231	22.800	0.030233540	3542.66	-19.75	1.87	0.0	0.0
232	22.900	0.030172215	3540.69	-19.56	2.05	0.0	0.0
233	23.000	0.030741823	3538.75	-19.36	2.21	0.0	0.0
234	23.100	0.031042851	3536.82	-19.11	2.37	0.0	0.0
235	23.200	0.030470532	3534.92	-18.87	2.52	0.0	0.0
236	23.300	-0.000184447	3533.05	-18.61	2.66	0.0	0.0
237	23.400	-0.000935868	3531.20	-18.34	2.79	0.0	0.0
238	23.500	-0.001597129	3529.38	-18.05	2.91	0.0	0.0
239	23.600	-0.002188008	3527.59	-17.76	3.02	0.0	0.0
240	23.700	-0.002725855	3525.83	-17.45	3.13	0.0	0.0
241	23.800	-0.003220468	3524.10	-17.13	3.23	0.0	0.0
242	23.900	-0.003712498	3522.41	-16.80	3.32	0.0	0.0
243	24.000	-0.004192441	3520.74	-16.47	3.40	0.0	0.0
244	24.100	-0.004680176	3519.11	-16.12	3.47	0.0	0.0
245	24.200	-0.005186382	3517.52	-15.77	3.54	0.0	0.0
246	24.300	-0.005710105	3515.96	-15.42	3.60	0.0	0.0
247	24.400	-0.006258409	3514.43	-15.05	3.65	0.0	0.0
248	24.500	-0.006828636	3512.95	-14.69	3.70	0.0	0.0
249	24.600	-0.007413792	3511.50	-14.31	3.74	0.0	0.0
250	24.700	-0.008006917	3510.08	-13.94	3.78	0.0	0.0
251	24.800	-0.008598128	3508.71	-13.56	3.80	0.0	0.0
252	24.900	-0.009169758	3507.37	-13.18	3.83	0.0	0.0
253	25.000	-0.009707116	3506.07	-12.79	3.84	0.0	0.0
254	25.100	-0.010204217	3504.81	-12.41	3.85	0.0	0.0
255	25.200	-0.010662543	3503.59	-12.04	3.85	0.0	0.0
256	25.300	-0.011012988	3502.41	-11.66	3.85	0.0	0.0
257	25.400	-0.011381087	3501.26	-11.28	3.83	0.0	0.0
258	25.500	-0.011582977	3500.16	-10.87	3.82	0.0	0.0
259	25.600	-0.011610685	3499.09	-10.49	3.78	0.0	0.0
260	25.700	-0.011623627	3498.06	-10.12	3.74	0.0	0.0
261	25.800	-0.011563759	3497.07	-9.76	3.72	0.0	0.0
262	25.900	-0.011373580	3496.11	-9.37	3.67	0.0	0.0
263	26.000	-0.011123966	3495.19	-9.01	3.62	0.0	0.0
264	26.100	-0.010886086	3494.31	-8.65	3.56	0.0	0.0
265	26.200	-0.010628787	3493.46	-8.30	3.49	0.0	0.0
266	26.300	-0.010318076	3492.65	-7.95	3.42	0.0	0.0
267	26.400	-0.009974534	3491.87	-7.61	3.35	0.0	0.0
268	26.500	-0.009628684	3491.13	-7.28	3.27	0.0	0.0
269	26.600	-0.009284017	3490.41	-6.96	3.19	0.0	0.0
270	26.700	-0.008967520	3489.73	-6.66	3.11	0.0	0.0
271	26.800	-0.008724813	3489.09	-6.36	3.02	0.0	0.0
272	26.900	-0.008519648	3488.47	-6.06	2.94	0.0	0.0
273	27.000	-0.007983328	3487.88	-5.75	2.86	0.0	0.0
274	27.100	-0.007226289	3487.32	-5.47	2.77	0.0	0.0
275	27.200	-0.007167719	3486.78	-5.19	2.69	0.0	0.0
276	27.150	-0.007185345	3486.26	-4.93	2.61	0.0	0.0
277	27.400	-0.007269332	3485.80	-4.67	2.53	0.0	0.0
278	27.500	-0.007612319	3485.34	-4.44	2.46	0.0	0.0
279	27.600	-0.007967598	3484.91	-4.18	2.39	0.0	0.0
280	27.700	-0.007936981	3484.51	-3.96	2.32	0.0	0.0
281	27.800	-0.008273297	3484.12	-3.73	2.25	0.0	0.0
282	27.900	-0.008658863	3483.76	-3.49	2.19	0.0	0.0
283	28.000	-0.009000037	3483.43	-3.28	2.13	0.0	0.0
284	28.100	-0.009358077	3483.11	-3.07	2.07	0.0	0.0
285	28.200	-0.009682055	3482.81	-2.86	2.01	0.0	0.0
286	28.300	-0.009959449	3482.54	-2.66	1.96	0.0	0.0
287	28.400	-0.010171889	3482.28	-2.47	1.90	0.0	0.0
288	28.500	-0.010383991	3482.04	-2.28	1.86	0.0	0.0
289	28.600	-0.010548225	3481.82	-2.10	1.78	0.0	0.0
290	28.700	-0.010278142	3481.62	-1.93	1.72	0.0	0.0
291	28.800	-0.010108945	3481.44	-1.76	1.65	0.0	0.0
292	28.900	-0.009828225	3481.27	-1.60	1.59	0.0	0.0
293	29.000	-0.009426883	3481.12	-1.44	1.52	0.0	0.0
294	29.100	-0.008923140	3480.98	-1.30	1.46	0.0	0.0
295	29.200	-0.008323921	3480.86	-1.15	1.36	0.0	0.0
296	29.300	-0.007638736	3480.75	-1.02	1.28	0.0	0.0
297	29.400	-0.006882356	3480.65	-0.90	1.20	0.0	0.0
298	29.500	-0.006072196	3480.57	-0.76	1.11	0.0	0.0
299	29.600	-0.005227451	3480.50	-0.68	1.03	0.0	0.0
300	29.700	-0.004370683	3480.43	-0.58	0.96	0.0	0.0
301	29.800	-0.003522327	3480.38	-0.49	0.88	0.0	0.0
302	29.900	-0.002705953	3480.33	-0.41	0.78	0.0	0.0
303	30.000	-0.001963660	3480.30	-0.34	0.67	0.0	0.0
304	30.100	-0.001236797	3480.27	-0.27	0.59	0.0	0.0
305	30.200	-0.000668096	3480.25	-0.22	0.50	0.0	0.0
306	30.300	-0.000186038	3480.22	-0.17	0.43	0.0	0.0
307	30.400	0.000168756	3480.21	-0.13	0.35	0.0	0.0
308	30.500	0.000379072	3480.20	-0.10	0.29	0.0	0.0
309	30.600	0.000446572	3480.19	-0.08	0.23	0.0	0.0
310	30.700	0.000385174	3480.18	-0.06	0.19	0.0	0.0
311	30.800	0.000136310	3480.18	-0.04	0.13	0.0	0.0
312	30.900	-0.000033935	3480.17	-0.03	0.10	0.0	0.0
313	31.000	-0.000734863	3480.17	-0.02	0.07	0.0	0.0
314	31.100	-0.001351234	3480.17	-0.01	0.05	0.0	0.0
315	31.200	-0.002363793	3480.17	-0.01	0.04	0.0	0.0
316	31.300	-0.002944063	3480.17	-0.01	0.04	0.0	0.0
317	31.400	-0.003882592	3480.17	-0.00	0.04	0.0	0.0
318	31.500	-0.004524656	3480.17	0.00	0.08	0.0	0.0
319	31.600	-0.005376234	3480.17	0.01	0.08	0.0	0.0
320	31.700	-0.006177371	3480.17	0.02	0.10	0.0	0.0
321	31.800	-0.006908721	3480.17	0.03	0.13	0.0	0.0
322	31.900	-0.007562565	3480.17	0.04	0.17	0.0	0.0
323	32.000	-0.008053682	3480.18	0.06	0.21	0.0	0.0
324	32.100	-0.008420641	3480.19	0.09	0.25	0.0	0.0
325	32.200	-0.008625402	3480.20	0.11	0.29	0.0	0.0
326	32.300	-0.008654066	3480.21	0.14	0.33	0.0	0.0
327	32.400	-0.008509361	3480.23	0.18	0.37	0.0	0.0
328	32.500	-0.008171968	3480.26	0.22	0.41	0.0	0.0
329	32.600	-0.007660670	3480.27	0.26	0.45	0.0	0.0
330	32.700	-0.006981328	3480.30	0.31	0.48	0.0	0.0
389	32.600	-0.006150721	3480.33	0.36	0.51	0.0	0.0

APPENDIX B

MODEL CHECK PROGRAM

User Instructions — MDLCK

The program is written in FORTRAN IV and is designed to run in double precision on an IBM 370/165 computer with an average execution time of 20 seconds per case. Execution requires approximately 146,000 bytes of core storage. Given the output of the FDR1 program (Appendix A), this program provides a quick means of determining feasible power-drag model forms and initial estimates of the power and drag coefficients which would shorten the execution time of the FDR2 program (see Appendix C).* The program requires the specification of the following input data:

CARD 1:

The read unit number IDS:
IDS is a right-adjusted integer number occupying columns 1-5 and specifying that the data is to be read from cards, magnetic tape, disk, etc. The user must supply the suitable job control cards for the tape and/or disk reads. The IDS parameter controls only the reading of CARDS 2, 3, and (4,...,3 + 5K). All other data is expected in CARD form.

CARD 2:

The title array TITLE1:
The 80 characters of the array TITLE1 are used for identifying output. TITLE1 is provided by the first card of the punched output of the FDR1 program.

CARD 3:

(a) The total number of points K in the data set,
(b) The aircraft's wing area S in square feet,
(c) The sea-level atmospheric density RHO in slug/ft^3,
(d) The acceleration due to gravity G in ft/sec^2, and
(e) The total elapsed time for the maneuver TT in seconds:
K is a right-adjusted integer number occupying columns 1-10. S, RHO, G, and TT are double-precision floating-point numbers each occupying 15 columns beginning at column 11. These values are provided by the second card of the punched output of the FDR1 program.

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* It must be emphasized that this program allows greater freedom in the specification of the power-drag model forms than does the FDR2 program. This program allows the inclusion of term for the rates of other independent variables, while the FDR2 program allows only "steady-state" conditions.

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CARDS 4,...,(3 + 5K):

The time histories of time T, weight F1, pitch angle F2, pitch rate F3, airspeed F4, density F5, angle of attack F6, static temperature X1, acceleration F8, angle-of-attack rate F9, altitude X2, altitude rate X3, altitude acceleration X4, vertical acceleration X5, and elevator deflection X6:

The variables T, F1, F2, F3, F4, F5, F6, X1, F8, F9, X2, X3, X4, X5, and X6 are double-precision floating-point numbers each occupying 25 columns. These variables are provided by the remaining punched output of the FDR1 program.

CARD (3 + 5K + 1):

The title array TITLE:

The 80 characters of the array TITLE are used for additional data set identification. Since this program allows more than one power-drag model form to be analyzed in a given run, TITLE is also used as a control variable to end execution. Termination of execution is achieved by following the last model-form data cards by a title card having only the word END in the first three card columns.

CARD (3 + 5K + 2):

(a) The power-drag model form parameters LOC(I):

The LOC(I), I = 1,...,15 parameters determine the specific model form to be used. The general form of the power and drag-coefficient equations are

$$\text{Power} = P_0 + P_1 V^{EX1} + P_2 V^{EX2} + P_3 V^{EX3} + P_4 V^{EX4} + P_5 \dot{V} + P_6 \dot{\alpha} + P_7 \dot{\theta}$$

$$C_D = C_{D_0} + C_{D_1} \alpha^{IEX1} + C_{D_2} \alpha^{IEX2} + C_{D_3} \alpha^{IEX3} + C_{D_4} \alpha^{IEX4} + C_{D_5} \dot{\alpha} + C_{D_6} \dot{\theta}$$

Through the use of the LOC(I) parameters, the user may include or exclude as many terms as desired. It is mandatory that at least one power term and at least one drag-coefficient term is included; otherwise, the program will terminate prematurely. The following chart should be used in the specification of the desired model(s):

LOC parameter	Corresponding Coefficient
LOC(1)	P_0
LOC(2)	P_1
LOC(3)	P_2
LOC(4)	P_3
LOC(5)	P_4
LOC(6)	P_5
LOC(7)	P_6
LOC(8)	P_7
LOC(9)	C_{D_0}
LOC(10)	C_{D_1}
LOC(11)	C_{D_2}
LOC(12)	C_{D_3}
LOC(13)	C_{D_4}
LOC(14)	C_{D_5}
LOC(15)	C_{D_6}

If LOC(I) = 0, the corresponding coefficient term will be excluded from the analysis. If LOC(I) = 1, the corresponding coefficient term will be included in the analysis. These parameters are right-adjusted integer numbers each occupying 1 column beginning at column 1.

(b) The desired type of output units METRIC:
If METRIC = Ø, the output will be in English units. If METRIC = 1, the output will be in SI units. METRIC is a right-adjusted integer number occupying column 16.

C-5

CARD (3 + 5K + 3):

(a) The exponent EX1 on the second power-coefficient term,
(b) The exponent EX2 on the third power-coefficient term,
(c) The exponent EX3 on the fourth power-coefficient term,
(d) The exponent EX4 on the fifth power-coefficient term,
(e) The exponent IEX1 on the second drag-coefficient term,
(f) The exponent IEX2 on the third drag-coefficient term,
(g) The exponent IEX3 on the fourth drag-coefficient term, and
(h) The exponent IEX4 on the fifth drag-coefficient term:
EX1, EX2, EX3, and EX4 are floating-point numbers each occupying 10 columns beginning at column 1. No two of these exponents may have the same value; otherwise, a singular matrix will terminate execution. IEX1, IEX2, IEX3, and IEX4 are right-adjusted integer numbers each occupying 5 columns beginning at column 41. No two of these exponents may have the same value; otherwise, a singular matrix will terminate execution.

CARD (3 + 5K + 4):

(a) The lower allowable limit PLOW of the power available in foot-pounds per second,
(b) The upper allowable limit PHIGH of the power available in foot-pounds per second,
(c) The lower allowable limit CDLOW of the drag coefficient,
(d) The upper allowable limit CDHIGH of the drag coefficient, and
(e) The thrust incidence angle TIA in radians:
PLOW, PHIGH, CDLOW, CDHIGH, and TIA are floating-point numbers each occupying 10 columns beginning at column 1.

For a given run consisting of more than one power-drag model form, cards (3 + 5K + 1) through (3 + 5K + 4) must be repeated for each model form.

Program Listing – MDLCK

```
C                                                                       ML    1
C  PROGRAM: MODEL FORMS CHECK (MDLCK)          F.O. SMETANA & S.R. FOX  ML    2
C                                                                       ML    3
C                                                                       ML    4
C                    ****************************************           ML    5
C                    *                                      *           ML    6
C                    *   M O D E L   F O R M S   C H E C K  *           ML    7
C                    *                                      *           ML    8
C                    ****************************************           ML    9
C                                                                       ML   10
C                                                                       ML   11
C                                                                       ML   12
C     GIVEN THE OUTPUT OF FLIGHT DATA REDUCTION PROGRAM #1, THIS PROGRAM ML   13
C     ALLOWS THE USER TO DETERMINE THE MODEL FORM(S) FOR THE POWER AND  ML   14
C     DRAG COEFFICIENTS FOR FLIGHT DATA REDUCTION PROGRAM #2.  IT SHOULD ML   15
C     BE EMPHASIZED THAT THIS PROGRAM ALLOWS GREATER FREEDOM THAN FLIGHT ML   16
C     DATA REDUCTION PROGRAM #2 IN THE REPRESENTATION OF THE POWER AND  ML   17
C     DRAG FUNCTIONS.                                                   ML   18
C                                                                       ML   19
C                                                                       ML   20
C                                                                       ML   21
C     THE FOLLOWING COMMENT CARDS DESCRIBE THE NECESSARY INPUT FOR THIS ML   22
C     PROGRAM.  FOR A MORE PRECISE DESCRIPTION, CONSULT THE USERS IN-   ML   23
C     STRUCTIONS.                                                       ML   24
C                                                                       ML   25
C INPUT *** CARD 1                                                      ML   26
C                                                                       ML   27
C         IOS     -> READ UNIT NUMBER (ALLOWS READING OF CARDS, DISK,   ML   28
C                    TAPE, ETC OF THE OUTPUT OF FLIGHT DATA REDUCTION   ML   29
C                    PROGRAM #1)                                        ML   30
C                                                                       ML   31
C                                                                       ML   32
C                                                                       ML   33
C INPUT *** CARD 2  (OUTPUT OF FLIGHT DATA REDUCTION PROGRAM #1)        ML   34
C                                                                       ML   35
C         TITLE1 -> TITLE CARD FOR MANEUVER                             ML   36
C                                                                       ML   37
C                                                                       ML   38
C                                                                       ML   39
C INPUT *** CARD 3  (OUTPUT OF FLIGHT DATA REDUCTION PROGRAM #1)        ML   40
C                                                                       ML   41
C         K       -> NUMBER OF POINTS IN DATA SET                       ML   42
C                                                                       ML   43
C         S       -> AIRCRAFT'S WING AREA IN SQUARE FEET                ML   44
C                                                                       ML   45
C         RHO     -> SEA-LEVEL ATMOSPHERIC DENSITY IN SLUG/FT**3        ML   46
C                                                                       ML   47
C         G       -> ACCELERATION DUE TO GRAVITY IN FT/SEC**2           ML   48
C                                                                       ML   49
C         TT      -> TOTAL ELAPSED TIME FOR MANEUVER IN SECONDS         ML   50
C                                                                       ML   51
C                                                                       ML   52
C                                                                       ML   53
C INPUT *** CARDS 4,....(3+5K)  (OUTPUT FROM 'FOR1')                   ML   54
C                                                                       ML   55
C         IDENTIFICATION OF NECESSARY INPUT TIME HISTORIES               ML   56
C                                                                       ML   57
C              T       -> TIME (DUMMY VARIABLE)                         ML   58
C              F1(I)   -> WEIGHT                                        ML   59
C              F2(I)   -> PITCH ANGLE                                   ML   60
C              F3(I)   -> PITCH RATE                                    ML   61
C              F4(I)   -> AIRSPEED                                      ML   62
C              F5(I)   -> DENSITY                                       ML   63
C              F6(I)   -> ANGLE OF ATTACK                               ML   64
C              X1      -> STATIC TEMPERATURE (DUMMY VARIABLE)           ML   65
C              F8(I)   -> ACCELERATION                                  ML   66
C              F9(I)   -> ANGLE OF ATTACK RATE                          ML   67
C              X2      -> ALTITUDE (DUMMY VARIABLE)                     ML   68
C              X3      -> ALTITUDE RATE (DUMMY VARIABLE)                ML   69
C              X4      -> ALTITUDE ACCELERATION (DUMMY VARIABLE)        ML   70
C              X5      -> VERTICAL ACCELERATION (DUMMY VARIABLE)        ML   71
C              X6      -> ELEVATOR/STABILATOR DEFLECTION (DUMMY VARIABLE) ML  72
C                                                                       ML   73
C                                                                       ML   74
C                                                                       ML   75
C INPUT *** CARD (3+5K+1)                                               ML   76
C                                                                       ML   77
C         TITLE  -> TITLE CARD FOR ADDITIONAL LABELING OR PROGRAM       ML   78
C                   TERMINATION                                         ML   79
C                                                                       ML   80
C                                                                       ML   81
C                                                                       ML   82
C INPUT *** CARD (3+5K+2)  (CONSULT USERS INSTRUCTIONS)                 ML   83
C                                                                       ML   84
C         LOC(I) -> MODEL SOLUTION FORM (CHOSEN BY CARD COLUMN NUMBER)  ML   85
C                   LOC(I)=0  -> SKIP COEFFICIENT                       ML   86
C                   LOC(I)=1  -> INCLUDE COEFFICIENT                    ML   87
C                                                                       ML   88
C         METRIC -> OUTPUT PRINT CODE                                   ML   89
C                   METRIC=0  -> OUTPUT PRINTED IN ENGLISH UNITS        ML   90
C                   METRIC=1  -> OUTPUT PRINTED IN SI UNITS             ML   91
C                                                                       ML   92
C                                                                       ML   93
C                                                                       ML   94
C INPUT *** CARD (3+5K+3)  (CONSULT USERS INSTRUCTIONS)                 ML   95
C                                                                       ML   96
C         EX1    -> EXPONENT ON SECOND POWER-COEFFICIENT TERM          ML   97
C                                                                       ML   98
C         EX2    -> EXPONENT ON THIRD POWER-COEFFICIENT TERM           ML   99
C                                                                       ML  100
C         EX3    -> EXPONENT ON FOURTH POWER-COEFFICIENT TERM          ML  101
C                                                                       ML  102
C         EX4    -> EXPONENT ON FIFTH POWER-COEFFICIENT TERM           ML  103
C                                                                       ML  104
C         IEX1   -> EXPONENT ON SECOND DRAG-COEFFICIENT TERM (INTEGER) ML  105
C                                                                       ML  106
C         IEX2   -> EXPONENT ON THIRD DRAG-COEFFICIENT TERM (INTEGER)  ML  107
C                                                                       ML  108
C         IEX3   -> EXPONENT ON FOURTH DRAG-COEFFICIENT TERM (INTEGER) ML  109
C                                                                       ML  110
C         IEX4   -> EXPONENT ON FIFTH DRAG-COEFFICIENT TERM (INTEGER)  ML  111
C                                                                       ML  112
C                                                                       ML  113
C                                                                       ML  114
C INPUT *** CARD (3+5K+4)                                               ML  115
C                                                                       ML  116
C         PLOW   -> LOWER LIMIT OF ALLOWABLE POWER AVAILABLE (FT-LB/SEC) ML 117
C                                                                       ML  118
C         PHIGH  -> UPPER LIMIT OF ALLOWABLE POWER AVAILABLE (FT-LB/SEC) ML 119
C                                                                       ML  120
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OF POOR QUALITY

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C          COLOW  -> LOWER LIMIT OF ALLOWABLE DRAG COEFFICIENT                ML  121
C                                                                             ML  122
C          COHIGH -> UPPER LIMIT OF ALLOWABLE DRAG COEFFICIENT               ML  123
C                                                                             ML  124
C          TIA    -> THRUST INCIDENCE ANGLE IN RADIANS                       ML  125
C                                                                             ML  126
C                                                                             ML  127
C *** ADDITIONAL MODEL FORMS MAY BE SPECIFIED BY 'REPEATING' PROCESS          ML  128
C     FROM CARD(3*SK+1) THROUGH CARD(3*SK+4).  THE PROGRAM IS TERMINATED      ML  129
C     WHEN CARD(3*SK+1) CONTAINS THE WORD 'END' IN THE FIRST THREE CARD       ML  130
C     COLUMNS.                                                                ML  131
C                                                                             ML  132
C                                                                             ML  133
C                                                                             ML  134
      IMPLICIT REAL*8(A-H,O-Z)                                                ML  135
      DIMENSION LOC(15),TITLE(20),TITLE1(20)                                  ML  136
      COMMON F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F8(450),F9(      ML  137
     1450),C(450,15),X(450,1),WKAR(450),CFM(15),SGN(4),EX1,EX2,EX3,EX4,G      ML  138
     1,S,RHO,TIA,PLOW,PHIGH,COLOW,COHIGH,JREAD,JWRITE,IEX1,IEX2,IEX3,IEX      ML  139
     14,METRIC                                                                ML  140
      DATA XEND/4HEND /                                                       ML  141
C                                                                             ML  142
C                                                                             ML  143
C***  SPECIFY CARRIAGE CONTROL FOR INSTALLATION                               ML  144
      JREAD=1                                                                 ML  145
      JPUNCH=2                                                                ML  146
      JWRITE=3                                                                ML  147
C                                                                             ML  148
C***  READ INPUT DATA                                                         ML  149
C                                                                             ML  150
C                                                                             ML  151
      READ (JREAD,1) IDS                                                      ML  152
    1 FORMAT (I5)                                                             ML  153
C***  CHECK IDS FOR ERROR                                                     ML  154
      IF (IDS.EQ.JPUNCH.OR.IDS.EQ.JWRITE) GO TO 11                            ML  155
      READ (IDS,2) (TITLE1(I),I=1,20)                                         ML  156
    2 FORMAT (20A4)                                                           ML  157
      READ (IDS,3) K,S,RHO,G                                                  ML  158
    3 FORMAT (I10,4D15.8)                                                     ML  159
      DO 5 I=1,K                                                              ML  160
      READ (IDS,4) T,F1(I),F2(I),F3(I),F4(I),F5(I),F6(I),X1,F8(I),F9(I),      ML  161
     1X2,X3,X4,X5,X6                                                          ML  162
    4 FORMAT (3D25.16)                                                        ML  163
    5 CONTINUE                                                                ML  164
C***  SET CASE COUNTER                                                        ML  165
      ICASE=0                                                                 ML  166
    6 READ (JREAD,2) (TITLE(I),I=1,20)                                        ML  167
C***  CHECK FOR PROGRAM TERMINATION                                           ML  168
      IF (TITLE(1).EQ.XEND) GO TO 13                                          ML  169
      READ (JREAD,7) (LOC(I),I=1,15),METRIC                                   ML  170
    7 FORMAT (16I1)                                                           ML  171
      READ (JREAD,8) EX1,EX2,EX3,EX4,IEX1,IEX2,IEX3,IEX4                      ML  172
    8 FORMAT (4F10.0,4I5)                                                     ML  173
      READ (JREAD,9) PLOW,PHIGH,COLOW,COHIGH,TIA                              ML  174
    9 FORMAT (5F10.0)                                                         ML  175
C                                                                             ML  176
C                                                                             ML  177
                                                                              ML  178
      WRITE (JWRITE,10) (TITLE1(I),I=1,20),(TITLE(I),I=1,20),IDS,LOC(1),      ML  179
     1LOC(7),LOC(13),EX1,PLOW,K,LOC(2),LOC(8),LOC(14),EX2,PHIGH,IEX1,LOC      ML  180
     1(3),LOC(9),LOC(15),EX3,COLOW,IEX2,LOC(4),LOC(10),S,EX4,COHIGH,IEX3      ML  181
     1,LOC(5),LOC(11),G,METRIC,IEX4,LOC(6),LOC(12),TIA,RHO                    ML  182
   10 FORMAT (1H1,////,20X,86('-'),/,20X,'|',82X,'|',/,20X,'|',82X,'|',      ML  183
     1X,'|',/,20X,'|',1X,20A4,1X,'|',/,20X,'|',82X,'|',/,20X,'|',82X,'|',    ML  184
     1/,20X,86('-'),//,20X,'INPUT PARAMETERS:',64X,'|',/,20X,'|',82X,'|',    ML  185
     1/,20X,'|',2X,'IDS=',I4,'  K=',I5,'  S=',F8.3,2X,'RHO=',F10.6,2X,'G=',  ML  186
     1F10.6,2X,'METRIC=',I3,//,20X,'|',/,20X,'|',2X,'IEX1=',I2,' LOC(1)=',   ML  187
     1I3,' LOC(7)=',I3,' LOC(13)=',I2,2X,'EX1=',F10.6,2X,'PLOW=',F10.6,2X,   ML  188
     1'PHIGH=',F10.6,2X,'COLOW=',F10.6,2X,'COHIGH=',F10.6,4X,'|',/,20X,'|',   ML  189
     1/,20X,'|',2X,'IEX2=',I3,' LOC(2)=',I3,' LOC(8)=',I3,' LOC(14)=',I3,    ML  190
     1' LOC(4)=',I3,' LOC(10)=',I3,' LOC(16)=',I3,//,20X,'|',/,20X,'|',2X,   ML  191
     1'IEX3=',I3,' LOC(5)=',I3,' LOC(11)=',I2,' LOC(6)=',I3,' LOC(12)=',I2,  ML  192
     1//,20X,'|',2X,'IEX4=',I3,' LOC(6)=',I3,' TIA=',F6.4,2X,'RHO=',1PD15.8,  ML  193
     1,18X,'|',/,20X,'|',82X,'|',/,20X,86('-'))                               ML  194
C***  UPDATE CASE COUNTER AND ENACT MODEL SOLUTION                            ML  195
      ICASE=ICASE+1                                                           ML  196
      CALL MODEL(K,ICASE,LOC)                                                 ML  197
C***  CONTINUE TO NEXT CASE IF ANY                                            ML  198
      GO TO 6                                                                 ML  199
C***  WRITE ERROR MESSAGE                                                     ML  200
   11 WRITE (JWRITE,12)                                                       ML  201
   12 FORMAT (1X,////,20X,'INPUT ERROR *** IDS IS INCORRECT')                 ML  202
   13 STOP                                                                    ML  203
      END                                                                     ML  204
                                                                              ML  205
      SUBROUTINE MODEL(K,ICASE,LOC)                                           MD    1
C                                                                             MD    2
C***  SUBROUTINE MODEL CALCULATES THE POWER AND DRAG COEFFICIENTS OF THE       MD    3
C***  USER-SPECIFIED MODEL FROM THE EQUATION OF MOTION TANGENT TO THE         MD    4
C***  FLIGHT PATH                                                             MD    5
C                                                                             MD    6
      IMPLICIT REAL*8(A-H,O-Z)                                                MD    7
      DIMENSION TS(15),LOC(15),LLOC(15),H(8)                                  MD    8
      COMMON F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F8(450),F9(      MD    9
     1450),C(450,15),X(450,1),WKAR(450),CFM(15),SGN(4),EX1,EX2,EX3,EX4,G      MD   10
     1,S,RHO,TIA,PLOW,PHIGH,COLOW,COHIGH,JREAD,JWRITE,IEX1,IEX2,IEX3,IEX      MD   11
     14,METRIC                                                                MD   12
      DATA FAIL/4HNOGO/                                                       MD   13
C                                                                             MD   14
      WRITE (JWRITE,1)                                                        MD   15
    1 FORMAT (1X,////,50X,27HM O D E L   S O L U T I O N,/)                   MD   16
C***  DETERMINE NUMBER OF UNKNOWNS                                            MD   17
      NUM=15                                                                  MD   18
      ICK1=0                                                                  MD   19
      ICK2=0                                                                  MD   20
      JC=0                                                                    MD   21
      DO 6 I=1,15                                                             MD   22
      IF (LOC(I))  21,2,3                                                     MD   23
    2 NUM=NUM-1                                                               MD   24
      GO TO 6                                                                 MD   25
    3 JC=JC+1                                                                 MD   26
      LLOC(JC)=I                                                              MD   27
      IF ((I-8))  4,4,5                                                       MD   28
    4 ICK1=ICK1+1                                                             MD   29
      GO TO 6                                                                 MD   30
    5 ICK2=ICK2+1                                                             MD   31
    6 CONTINUE                                                                MD   32
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C***  DETERMINE IF AT LEAST ONE POWER COEFFICIENT AND ONE DRAG COEF-     MD   33
C***  FICIENT IS SPECIFIED                                              MD   34
      IF ((ICK1.EQ.0.OR.ICK2.EQ.0) GO TO 21                             MD   35
C***  BEGIN MODEL SOLUTION                                              MD   36
      NFL=0                                                             MD   37
      CALL CHNGE(SGN)                                                   MD   38
      DO 8 I=1,K                                                        MD   39
      AM=DABS(F6(I))                                                    MD   40
C***  TEST FOR NEGATIVE ANGLES OF ATTACK                                MD   41
      IF (F6(I).LT.0.000) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)           MD   42
C***  DETERMINE GENERAL TERMS FOR MATRIX FORMULATION                    MD   43
      TS(I)=DCOS(F6(I)+TIA)/(F1(I)*F4(I))                               MD   44
      TS(2)=TS(I)*F4(I)**EX1                                            MD   45
      TS(3)=TS(I)*F4(I)**EX2                                            MD   46
      TS(4)=TS(I)*F4(I)**EX3                                            MD   47
      TS(5)=TS(I)*F4(I)**EX4                                            MD   48
      TS(6)=TS(I)*F5(I)                                                 MD   49
      TS(7)=TS(I)*F9(I)                                                 MD   50
      TS(8)=TS(I)*F3(I)                                                 MD   51
      TS(9)=-FS(I)*S*F4(I)**2/(2.0D0*F1(I))                             MD   52
      TS(10)=TS(9)*SGN(1)*AM**EX1                                       MD   53
      TS(11)=TS(9)*SGN(2)*AM**EX2                                       MD   54
      TS(12)=TS(9)*SGN(3)*AM**EX3                                       MD   55
      TS(13)=TS(9)*SGN(4)*AM**EX4                                       MD   56
      TS(14)=TS(9)*F9(I)                                                MD   57
      TS(15)=TS(9)*F3(I)                                                MD   58
      IF (F6(I).LT.0.000) CALL CHNGE(SGN)                               MD   59
C***  FORM COEFFICIENTS FOR LEAST SQUARES                               MD   60
      DO 7 J=1,NUM                                                      MD   61
    7 C(I,J)=TS(LLOC(J))                                                MD   62
    8 X(I,1)=F8(I)/G*DSIN(F2(I)-F6(I))                                  MD   63
C***  ENACT LEAST SQUARES                                               MD   64
      CALL LLSQAR(C,X,K,NUM,1,.450,450,10,WKAR,IER,JWRITE)              MD   65
C***  CHECK FOR ERROR                                                   MD   66
      IF (IER.EQ.129) GO TO 9                                           MD   67
      GO TO 11                                                          MD   68
    9 WRITE (JWRITE,10)                                                 MD   69
   10 FORMAT (1X,///,10X,'ZERO MATRIX ENCOUNTERED IN THIS MODEL CASE.  TO MD   70
     1 NEXT MODEL CASE, IF ANY.')                                       MD   71
      RETURN                                                            MD   72
C***  DEFINE COEFFICIENTS IN CORRECT ORDER                              MD   73
   11 DO 12 J=1,15                                                      MD   74
   12 CFM(J)=0.0D0                                                      MD   75
      DO 13 J=1,NUM                                                     MD   76
   13 CFM(LLOC(J))=X(J,1)                                               MD   77
C***  DETERMINE FIT ERROR                                               MD   78
      SSX=0.0D0                                                         MD   79
      DO 14 J=1,K                                                       MD   80
      AM=DABS(F6(J))                                                    MD   81
      IF (F6(J).LT.0.0D0) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)           MD   82
      P=CFM(1)*CFM(2)*F4(J)**EX1*CFM(3)*F4(J)**EX2*CFM(4)*F4(J)**EX3*CFM MD   83
     1(5)*F4(J)**EX4*CFM(6)*F8(J)*CFM(7)*F9(J)*CFM(8)*F3(J)             MD   84
      CD=CFM(9)*CFM(10)*SGN(1)*AM**IEX1*CFM(11)*SGN(2)*AM**IEX2*CFM(12)* MD   85
     1SGN(3)*AM**IEX3*CFM(13)*SGN(4)*AM**IEX4*CFM(14)*F9(J)*CFM(15)*F3(J MD   86
     1)                                                                 MD   87
C***  CHECK POWER AND DRAG COEFFICIENT RANGE                            MD   88
      IF ((P.LE.PLOW.OR.P.GT.PHIGH).OR.(CD.LT.COLOW.OR.CD.GE.CDHIGH))NFL MD   89
     1=NFL+1                                                            MD   90
      SS=DCOS(F6(J)+TIA)*P/(F1(J)*F4(J))-(FS(J)*S*F4(J)**2/(2.0D0*F1(J)) MD   91
     1*CD+F8(J)/G*DSIN(F2(J)-F6(J)))                                    MD   92
   14 SSX=SSX+SS*SS                                                     MD   93
C***  WRITE MODEL VALUES                                                MD   94
      IF (METRIC.NE.0) GO TO 18                                         MD   95
      IF (NFL.GT.0) GO TO 16                                            MD   96
      WRITE (JWRITE,15) ICASE,CFM(1),CFM(9),CFM(2),CFM(10),CFM(3),CFM(11 MD   97
     1),CFM(4),CFM(12),NFL,CFM(5),CFM(13),CFM(6),CFM(14),CFM(7),CFM(15), MD   98
     1CFM(8),SSX                                                        MD   99
   15 FORMAT (28X,76('*'),/,28X,'*',74X,'*',/,28X,'*',2X,'CASE',I2,4X,'P MD  100
     1O = ',1PD23.16,3X,'CD0 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P1 = ',1 MD  101
     1PD23.16,3X,'CD1 = ',1PD23.16,2X,'*',/,28X,'*',1X,'POINT',6X,'P2 =  MD  102
     1',1PD23.16,3X,'CD2 = ',1PD23.16,2X,'*',/,28X,'*',1X,'FAILURES',3X, MD  103
     1'P3 = ',1PD23.16,3X,'CD3 = ',1PD23.16,2X,'*',/,28X,'*',1X,'=',I4,6 MD  104
     1X,'P4 = ',1PD23.16,3X,'CD4 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P5 = MD  105
     1 ',1PD23.16,3X,'CD5 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P6 = ',1PD2 MD  106
     13.16,3X,'CD6 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P7 = ',1PD23.16,34 MD  107
     1X,'*',/,28X,'*',74X,'*',/,28X,'*',1X,'FIT ERROR= ',D23.16,39X,'*', MD  108
     1/,28X,'*',74X,'*',/,28X,76('*'))                                  MD  109
      RETURN                                                            MD  110
   16 WRITE (JWRITE,17) ICASE,CFM(1),CFM(9),CFM(2),CFM(10),CFM(3),CFM(11 MD  111
     1),CFM(4),CFM(12),NFL,CFM(5),CFM(13),CFM(6),CFM(14),CFM(7),CFM(15), MD  112
     1CFM(8),FAIL                                                       MD  113
   17 FORMAT (28X,76('*'),/,28X,'*',74X,'*',/,28X,'*',2X,'CASE',I2,4X,'P MD  114
     1O = ',1PD23.16,3X,'CD0 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P1 = ',1 MD  115
     1PD23.16,3X,'CD1 = ',1PD23.16,2X,'*',/,28X,'*',1X,'POINT',6X,'P2 =  MD  116
     1',1PD23.16,3X,'CD2 = ',1PD23.16,2X,'*',/,28X,'*',1X,'FAILURES',3X, MD  117
     1'P3 = ',1PD23.16,3X,'CD3 = ',1PD23.16,2X,'*',/,28X,'*',1X,'=',I4,6 MD  118
     1X,'P4 = ',1PD23.16,3X,'CD4 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P5 = MD  119
     1 ',1PD23.16,3X,'CD5 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P6 = ',1PD2 MD  120
     13.16,3X,'CD6 = ',1PD23.16,2X,'*',/,28X,'*',12X,'P7 = ',1PD23.16,34 MD  121
     1X,'*',/,28X,'*',74X,'*',/,28X,'*',1X,'FIT ERROR= ',A4,58X,'*',/,28 MD  122
     1X,'*',74X,'*',/,28X,76('*'))                                      MD  123
      RETURN                                                            MD  124
   18 DO 19 L=1,8                                                       MD  125
   19 H(L)=CFM(L)*1.3556180-3                                           MD  126
      IF (NFL.GT.0) GO TO 20                                            MD  127
      WRITE (JWRITE,15) ICASE,H(1),CFM(9),H(2),CFM(10),H(3),CFM(11),H(4) MD  128
     1,CFM(12),NFL,H(5),CFM(13),H(6),CFM(14),H(7),CFM(15),H(8),SSX      MD  129
      RETURN                                                            MD  130
   20 WRITE (JWRITE,17) ICASE,H(1),CFM(9),H(2),CFM(10),H(3),CFM(11),H(4) MD  131
     1,CFM(12),NFL,H(5),CFM(13),H(6),CFM(14),H(7),CFM(15),H(8),FAIL     MD  132
      RETURN                                                            MD  133
   21 WRITE (JWRITE,22)                                                 MD  134
   22 FORMAT (1X,////,20X,'INPUT ERROR *** USER SPECIFIED AT LEAST ONE L MD  135
     1OC PARAMETER INCORRECTLY.')                                       MD  136
      RETURN                                                            MD  137
      END                                                               MD  138



      SUBROUTINE SIGNS(Y,X1,X2,X3,X4)                                   SN    1
C                                                                       SN    2
C***  SUBROUTINE SIGNS DETERMINES THE CORRECT SIGN ON TERMS IN          SN    3
C***  COMPUTING THE DRAG COEFFICIENT EXPRESSION OR ITS DERIVATIVES IN   SN    4
C***  RELATION TO ARGUMENT AND EXPONENTS                                SN    5
C                                                                       SN    6
      IMPLICIT REAL*8(A-H,O-Z)                                          SN    7
      INTEGER*4 X1,X2,X3,X4                                             SN    8
      DIMENSION Y(4),L(4)                                               SN    9
C                                                                       SN   10
      DO 1 I=1,4                                                        SN   11
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    1 Y(I)=1.0D0                                                          SN   12
      L(1)=X1                                                             SN   13
      L(2)=X2                                                             SN   14
      L(3)=X3                                                             SN   15
      L(4)=X4                                                             SN   16
      DO 2 I=1,4                                                          SN   17
      IF (((L(I)/2)*2).NE.L(I))Y(I)=-1.0D0                                SN   18
    2 CONTINUE                                                            SN   19
      RETURN                                                              SN   20
      ENTRY CHNGE(Y)                                                      SN   21
      DO 3 I=1,4                                                          SN   22
    3 Y(I)=1.0D0                                                          SN   23
      RETURN                                                              SN   24
      END                                                                 SN   25



      SUBROUTINE LLSQAR(A,B,M,NA,NB,IA,IB,IDGT,WKAREA,IER,JWRITE)         LQ    1
C                                                                         LQ    2
C***  SUBROUTINE LLSQAR PERFORMS A LEAST SQUARES SOLUTION OF A OVER-      LQ    3
C***  DETERMINED SYSTEM OF LINEAR EQUATIONS                               LQ    4
C                                                                         LQ    5
      DIMENSION A(IA,1),B(IB,1),WKAREA(1)                                 LQ    6
      REAL*8 SUM                                                          LQ    7
      REAL*8 A,B,WKAREA                                                   LQ    8
C                                                                         LQ    9
C***  INITIALIZE IER                                                      LQ   10
      IER=0                                                               LQ   11
C***  FIND THE PSEUDO-INVERSE OF MATRIX A                                 LQ   12
      CALL LPSDOR(A,M,NA,IA,A,IDGT,WKAREA,IER,JWRITE)                     LQ   13
      IF (IER.NE.0) GO TO 5                                               LQ   14
C***  SOLVE THE EQUATION BY MULTIPLYING A-INVERSE AND B                   LQ   15
      DO 4 I=1,NB                                                         LQ   16
      DO 2 J=1,NA                                                         LQ   17
      CALL VXPZRO                                                         LQ   18
      DO 1 K=1,M                                                          LQ   19
      CALL VXPMUL(A(K,J),B(K,I))                                          LQ   20
    1 CONTINUE                                                            LQ   21
      CALL VXPSTO(SUM)                                                    LQ   22
      WKAREA(J)=SUM                                                       LQ   23
    2 CONTINUE                                                            LQ   24
C***  MOVE THE RESULTS INTO MATRIX B                                      LQ   25
      DO 3 J=1,NA                                                         LQ   26
      B(J,I)=WKAREA(J)                                                    LQ   27
    3 CONTINUE                                                            LQ   28
    4 CONTINUE                                                            LQ   29
      GO TO 6                                                             LQ   30
    5 IER=129                                                             LQ   31
      CALL UERTST(IER,6HLLSQAR,JWRITE)                                    LQ   32
    6 RETURN                                                              LQ   33
      END                                                                 LQ   34



      SUBROUTINE LPSDOR(A,M,N,IA,AINV,IDGT,WKAREA,IER,JWRITE)             PI    1
C                                                                         PI    2
C***  SUBROUTINE LPSDOR FIND THE PSEUDO-INVERSE OF A MATRIX               PI    3
C                                                                         PI    4
      DIMENSION A(IA,1),AINV(IA,1),WKAREA(N,1)                            PI    5
      REAL*8 A,AINV,WKAREA,BIGA,ANN,ZERO,ETA                              PI    6
      REAL*8 SUM,DETA                                                     PI    7
C                                                                         PI    8
C***  INITIALIZE IER                                                      PI    9
      IER=0                                                               PI   10
      NP1=N+1                                                             PI   11
      NP2=N+2                                                             PI   12
      NP3=N+3                                                             PI   13
C***  FIND THE LARGEST ELEMENT OF A                                       PI   14
      BIGA=0.D0                                                           PI   15
      DO 1 I=1,M                                                          PI   16
      DO 1 II=1,N                                                         PI   17
      IF (BIGA.GE.DABS(A(I,II))) GO TO 1                                  PI   18
      BIGA=DABS(A(I,II))                                                  PI   19
    1 CONTINUE                                                            PI   20
      ANN=MON                                                             PI   21
      ETA=DSQRT(ANN)/(10.**IDGT)*BIGA                                     PI   22
C***  CALCULATE THE SINGULAR VALUE DECOMPOSITION OF A                     PI   23
      CALL LSVALR(A,M,N,IA,N,1,WKAREA(1,N+4),WKAREA(1,NP1),AINV,WKAREA)   PI   24
      DO 2 I=1,N                                                          PI   25
    2 WKAREA(I,NP2)=WKAREA(I,NP1)                                         PI   26
C***  SORT THE SINGULAR VALUES ARRAY INTO ASCENDING SEQUENCE BY ABSOLUTE   PI   27
C***  VALUE                                                               PI   28
      CALL VSORTM(WKAREA(1,NP2),N)                                        PI   29
      DETA=ETA**2                                                         PI   30
      CALL VXPZRO                                                         PI   31
C***  COMPARE SINGULAR VALUES AND ETA                                     PI   32
      DO 3 I=1,N                                                          PI   33
      IP=I                                                                PI   34
      CALL VXPMUL(WKAREA(I,NP2),WKAREA(I,NP2))                            PI   35
      CALL VXPSTO(SUM)                                                    PI   36
      IF (SUM.GT.DETA) GO TO 4                                            PI   37
    3 CONTINUE                                                            PI   38
      IER=129                                                             PI   39
      GO TO 15                                                            PI   40
    4 IP=IP-1                                                             PI   41
      IF (IP.NE.0) GO TO 5                                                PI   42
      ZERO=0.D0                                                           PI   43
      GO TO 6                                                             PI   44
    5 ZERO=WKAREA(IP,NP2)                                                 PI   45
    6 DO 10 I=1,N                                                         PI   46
      IF (WKAREA(I,NP1).LE.ZERO) GO TO 8                                  PI   47
      DO 7 J=1,N                                                          PI   48
    7 WKAREA(J,I)=WKAREA(J,I)/WKAREA(I,NP1)                               PI   49
      GO TO 10                                                            PI   50
C***  SET WKAREA(J,I)=0.0 FOR J=1,...,N, IF WKAREA(I,NP1).LE.ZERO         PI   51
    8 DO 9 J=1,N                                                          PI   52
    9 WKAREA(J,I)=0.0                                                     PI   53
   10 CONTINUE                                                            PI   54
      DO 14 I=1,N                                                         PI   55
      DO 12 J=1,N                                                         PI   56
      CALL VXPZRO                                                         PI   57
      DO 11 K=1,N                                                         PI   58
   11 CALL VXPMUL(WKAREA(J,K),AINV(I,K))                                  PI   59
      CALL VXPSTO(SUM)                                                    PI   60
   12 WKAREA(J,NP3)=SUM                                                   PI   61
C***  MOVE THE RESULTS INTO MATRIX AINV                                   PI   62
      DO 13 J=1,N                                                         PI   63
   13 AINV(I,J)=WKAREA(J,NP3)                                             PI   64
   14 CONTINUE                                                            PI   65
      GO TO 16                                                            PI   66
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      18 CALL UERTST(IER,6HLPSDOR,JWRITE)                                PI   67
      16 RETURN                                                          PI   68
         END                                                             PI   69


         SUBROUTINE LSVALR(A,M,N,IA,IV,ISW,WKAREA,Q,U,V)
C                                                                        SV    1
C***  SUBROUTINE LSVALR DETERMINES THE SINGULAR VALUE DECOMPOSITION OF A SV    2
C***  MATRIX                                                             SV    3
C                                                                        SV    4
         DIMENSION A(IA,1),U(IA,1),V(IV,1),Q(1),WKAREA(1)                SV    5
         REAL*8A,WKAREA,Q,U,V,EPS,TOL                                    SV    6
         REAL*8F,G,H,X,Y,Z,C,S,HR,GR,DPS,ONE,ZERO                        SV    7
         DATA TOL/Z3D10000000000000/,DPS/Z3410000000000000/              SV    8
         DATA ONE/1.0D0/,ZERO/0.0D0/                                     SV    9
C                                                                        SV   10
         EPS=DPS                                                         SV   11
         DO 1 I=1,N                                                      SV   12
         DO 1 J=1,N                                                      SV   13
         U(I,J)=A(I,J)                                                   SV   14
       1 CONTINUE                                                        SV   15
C***  HOUSEHOLDER'S REDUCTION TO BIDIAGONAL FORM                         SV   16
         X=0.D0                                                          SV   17
         G=0.D0                                                          SV   18
         DO 17 I=1,N                                                     SV   19
         WKAREA(I)=G                                                     SV   20
         CALL VXPZRO                                                     SV   21
         L=I+1                                                           SV   22
         DO 2 J=I,N                                                      SV   23
       2 CALL VXPMUL(U(J,I),U(J,I))                                      SV   24
         CALL VXPSTO(S)                                                  SV   25
         IF (S.GE.TOL) GO TO 3                                           SV   26
         G=0.D0                                                          SV   27
         GO TO 7                                                         SV   28
       3 F=U(I,I)                                                        SV   29
         G=-DSQRT(S)                                                     SV   30
         IF (F.LT.0.D0)G=-G                                              SV   31
         H=F*G-S                                                         SV   32
         HR=1.0/H                                                        SV   33
         U(I,I)=F-G                                                      SV   34
         IF (L.GT.N) GO TO 7                                             SV   35
         DO 6 J=L,N                                                      SV   36
         CALL VXPZRO                                                     SV   37
         DO 4 K=I,N                                                      SV   38
       4 CALL VXPMUL(U(K,I),U(K,J))                                      SV   39
         CALL VXPSTO(S)                                                  SV   40
         F=S*HR                                                          SV   41
         DO 5 K=I,N                                                      SV   42
       5 U(K,J)=U(K,J)+F*U(K,I)                                          SV   43
       6 CONTINUE                                                        SV   44
       7 Q(I)=G                                                          SV   45
         CALL VXPZRO                                                     SV   46
         IF (L.GT.N) GO TO 9                                             SV   47
         DO 8 J=L,N                                                      SV   48
       8 CALL VXPMUL(U(I,J),U(I,J))                                      SV   49
         CALL VXPSTO(S)                                                  SV   50
       9 IF (S.GE.TOL) GO TO 10                                          SV   51
         G=0.D0                                                          SV   52
         GO TO 16                                                        SV   53
                                                                         SV   54
      10 IF (I.LT.N)F=U(I,I+1)                                           SV   55
         G=-DSQRT(S)                                                     SV   56
         IF (F.LT.0.D0)G=-G                                              SV   57
         H=F*G-S                                                         SV   58
         HR=1.0/H                                                        SV   59
         IF (I.LT.N)U(I,I+1)=F-G                                         SV   60
         IF (L.GT.N) GO TO 12                                            SV   61
         DO 11 J=L,N                                                     SV   62
      11 WKAREA(J)=U(I,J)*HR                                             SV   63
      12 IF (L.GT.N) GO TO 16                                            SV   64
         DO 15 J=L,N                                                     SV   65
         CALL VXPZRO                                                     SV   66
         IF (L.GT.N) GO TO 15                                            SV   67
         DO 13 K=L,N                                                     SV   68
      13 CALL VXPMUL(U(J,K),U(I,K))                                      SV   69
         CALL VXPSTO(S)                                                  SV   70
         DO 14 K=L,N                                                     SV   71
      14 U(J,K)=U(J,K)+S*WKAREA(K)                                       SV   72
      15 CONTINUE                                                        SV   73
      16 Y=DABS(Q(I))+DABS(WKAREA(I))                                    SV   74
         IF (Y.GT.X)X=Y                                                  SV   75
      17 CONTINUE                                                        SV   76
C***  ACCUMULATION OF RIGHT HAND TRANSFORMATIONS                         SV   77
         IF (ISW.EQ.0) GO TO 37                                          SV   78
         DO 25 I=1,N                                                     SV   79
         II=N-I+1                                                        SV   80
         IF (G.EQ.0.D0) GO TO 22                                         SV   81
         IF (L.GT.N) GO TO 24                                            SV   82
         H=U(II,II+1)*G                                                  SV   83
         HR=1.0/H                                                        SV   84
         DO 18 J=L,N                                                     SV   85
      18 V(J,II)=U(II,J)*HR                                              SV   86
         DO 21 J=L,N                                                     SV   87
         CALL VXPZRO                                                     SV   88
         DO 19 K=L,N                                                     SV   89
      19 CALL VXPMUL(U(II,K),V(K,J))                                     SV   90
         CALL VXPSTO(S)                                                  SV   91
         DO 20 K=L,N                                                     SV   92
      20 V(K,J)=V(K,J)+S*V(K,II)                                         SV   93
      21 CONTINUE                                                        SV   94
      22 IF (L.GT.N) GO TO 24                                            SV   95
         DO 23 J=L,N                                                     SV   96
         V(J,II)=0.D0                                                    SV   97
      23 V(II,J)=0.D0                                                    SV   98
      24 V(II,II)=1.000                                                  SV   99
         G=WKAREA(II)                                                    SV  100
      25 L=II                                                           SV  101
C***  ACCUMULATION OF LEFT HAND TRANSFORMATIONS                          SV  102
         DO 36 I=1,N                                                     SV  103
         II=N-I+1                                                        SV  104
         LL=II+1                                                         SV  105
         G=Q(II)                                                         SV  106
         IF (LL.GT.N) GO TO 27                                           SV  107
         DO 26 J=LL,N                                                    SV  108
      26 U(II,J)=0.D0                                                    SV  109
      27 IF (G.EQ.0.D0) GO TO 33                                         SV  110
         H=U(II,II)*G                                                    SV  111
         HR=1.0/H                                                        SV  112
         IF (LL.GT.N) GO TO 31                                           SV  113
         DO 30 J=LL,N                                                    SV  114
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      CALL VXPZRO                                                       SV  115
      DO 28 K=LL,N                                                      SV  116
   28 CALL VXPMUL(U(K,II),U(K,J))                                       SV  117
      CALL VXPSTO(S)                                                    SV  118
      F=S*HR                                                            SV  119
      DO 29 K=II,N                                                      SV  120
   29 U(K,J)=U(K,J)+F*U(K,II)                                           SV  121
   30 CONTINUE                                                          SV  122
   31 GR=1.0/G                                                          SV  123
      DO 32 J=II,N                                                      SV  124
   32 U(J,II)=U(J,II)*GR                                                SV  125
      GO TO 35                                                          SV  126
   33 DO 34 J=II,N                                                      SV  127
   34 U(J,II)=0.D0                                                      SV  128
   35 U(II,II)=U(II,II)+1.0D0                                           SV  129
   36 CONTINUE                                                          SV  130
C***  DIAGONALIZATION OF THE BIDIAGONAL FORM                           SV  131
   37 EPS=EPS*X                                                         SV  132
      DO 57 K=1,N                                                       SV  133
      KK=N-K+1                                                          SV  134
C***  TEST F SPLITTING                                                 SV  135
   38 DO 39 L=1,KK                                                      SV  136
      LL=KK-L+1                                                         SV  137
      IF (DABS(WKAREA(LL)).LE.EPS) GO TO 45                             SV  138
      IF (LL.EQ.1) GO TO 45                                             SV  139
      IF (DABS(Q(LL-1)).LE.EPS) GO TO 40                                SV  140
   39 CONTINUE                                                          SV  141
C***  CANCELLATION OF WKAREA(L) IF LL.GT.1                             SV  142
   40 C=0.D0                                                            SV  143
      S=1.0D0                                                           SV  144
      L1=LL-1                                                           SV  145
      IF (KK.LT.LL) GO TO 45                                            SV  146
      DO 44 I=LL,KK                                                     SV  147
      F=S*WKAREA(I)                                                     SV  148
      WKAREA(I)=C*WKAREA(I)                                             SV  149
      IF (DABS(F).LE.EPS) GO TO 45                                      SV  150
      G=Q(I)                                                            SV  151
      Q(I)=DSQRT(F*F+G*G)                                               SV  152
      H=Q(I)                                                            SV  153
      IF (H.NE.ZERO) GO TO 41                                           SV  154
      C=ZERO                                                            SV  155
      S=ONE                                                             SV  156
      GO TO 42                                                          SV  157
   41 C=G/H                                                             SV  158
      S=-F/H                                                            SV  159
   42 IF (ISW.EQ.0) GO TO 44                                            SV  160
      DO 43 J=1,M                                                       SV  161
      Y=U(J,L1)                                                         SV  162
      Z=U(J,I)                                                          SV  163
      U(J,L1)=Y*C+Z*S                                                   SV  164
   43 U(J,I)=-Y*S+Z*C                                                   SV  165
   44 CONTINUE                                                          SV  166
C***  TEST F CONVERGENCE                                               SV  167
   45 Z=Q(KK)                                                           SV  168
      IF (LL.EQ.KK) GO TO 55                                            SV  169
C***  SHIFT FROM BOTTOM 2X2 MINOR                                      SV  170
      X=Q(LL)                                                           SV  171
      IF (KK.GT.1)Y=Q(KK-1)                                             SV  172
      IF (KK.GT.1)G=WKAREA(KK-1)                                        SV  173
      H=WKAREA(KK)                                                      SV  174
      F=((Y-Z)*(Y+Z)+(G-H)*(G+H))/(2.D00*H*Y)                           SV  175
      G=DSQRT(F*F+ONE)                                                  SV  176
      IF (F.LT.0.D0)F=((X-Z)*(X+Z)+H*(Y/(F-G)-H))/X                     SV  177
      IF (F.GE.0.D0)F=((X-Z)*(X+Z)+H*(Y/(F+G)-H))/X                     SV  178
C***  NEXT QR TRANSFORMATION                                           SV  179
      C=1.0D0                                                           SV  180
      S=1.0D0                                                           SV  181
      L2=LL+1                                                           SV  182
      IF (KK.LT.L2) GO TO 54                                            SV  183
      DO 53 I=L2,KK                                                     SV  184
      G=WKAREA(I)                                                       SV  185
      Y=Q(I)                                                            SV  186
      H=S*G                                                             SV  187
      G=C*G                                                             SV  188
      Z=DSQRT(F*F+H*H)                                                  SV  189
      WKAREA(I-1)=Z                                                     SV  190
      IF (Z.NE.ZERO) GO TO 46                                           SV  191
      C=ZERO                                                            SV  192
      S=ONE                                                             SV  193
      GO TO 47                                                          SV  194
   46 C=F/Z                                                             SV  195
      S=H/Z                                                             SV  196
   47 F=X*C+G*S                                                         SV  197
      G=-X*S+G*C                                                        SV  198
      H=Y*S                                                             SV  199
      Y=Y*C                                                             SV  200
      IF (ISW.EQ.0) GO TO 49                                            SV  201
      DO 48 J=1,N                                                       SV  202
      X=V(J,I-1)                                                        SV  203
      Z=V(J,I)                                                          SV  204
      V(J,I-1)=X*C+Z*S                                                  SV  205
   48 V(J,I)=-X*S+Z*C                                                   SV  206
   49 Z=DSQRT(F*F+H*H)                                                  SV  207
      Q(I-1)=Z                                                          SV  208
      IF (Z.NE.ZERO) GO TO 50                                           SV  209
      C=ZERO                                                            SV  210
      S=ONE                                                             SV  211
      GO TO 51                                                          SV  212
   50 C=F/Z                                                             SV  213
      S=H/Z                                                             SV  214
   51 F=C*G+S*Y                                                         SV  215
      X=-S*G+C*Y                                                        SV  216
      IF (ISW.EQ.0) GO TO 53                                            SV  217
      DO 52 J=1,M                                                       SV  218
      Y=U(J,I-1)                                                        SV  219
      Z=U(J,I)                                                          SV  220
      U(J,I-1)=Y*C+Z*S                                                  SV  221
   52 U(J,I)=-Y*S+Z*C                                                   SV  222
   53 CONTINUE                                                          SV  223
   54 WKAREA(LL)=ZERO                                                   SV  224
      WKAREA(KK)=F                                                      SV  225
      Q(KK)=X                                                           SV  226
      GO TO 38                                                          SV  227
C***  CONVERGENCE                                                      SV  228
   55 IF (Z.GE.ZERO) GO TO 57                                           SV  229
      Q(KK)=-Z                                                          SV  230
      IF (ISW.EQ.0) GO TO 57                                            SV  231
      DO 56 J=1,N                                                       SV  232
   56 V(J,KK)=-V(J,KK)                                                  SV  233
   57 CONTINUE                                                          SV  234
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```
      RETURN                                                            SV  235
      END                                                               SV  236


      SUBROUTINE UERTST(IER,NAME,JWRITE)                                UR    1
C                                                                       UR    2
C***  SUBROUTINE UERTST GENERATES ERROR MESSAGES                        UR    3
C                                                                       UR    4
      DIMENSION ITYP(5,4),IBIT(4)                                       UR    5
      INTEGER*2 NAME(3)                                                 UR    6
      INTEGER WARN,WARF,TERM,JWRITE                                     UR    7
      EQUIVALENCE (IBIT(1),WARN),(IBIT(2),WARF),(IBIT(3),TERM)          UR    8
      DATA ITYP/'WARN','ING ','.'    ','    ','.'    ','WARN','.','ING','.','WITH',  UR    9
     1' FIX','.')   ','TERM','.','INAL','.'    ','    ','.'    ','NON-','DEFI','NE  UR   10
     1D '.'    ','    '/,IBIT/32,64,128,0/                             UR   11
                                                                        UR   12
C                                                                       UR   13
      IER2=IER                                                          UR   14
      IF (IER2.GE.WARN) GO TO 1                                         UR   15
C***  UNDEFINED                                                         UR   16
      IER1=4                                                            UR   17
      GO TO 4                                                           UR   18
    1 IF (IER2.LT.TERM) GO TO 2                                         UR   19
C***  TERMINAL                                                          UR   20
      IER1=3                                                            UR   21
      GO TO 4                                                           UR   22
    2 IF (IER2.LT.WARF) GO TO 3                                         UR   23
C***  WARNING (WITH FIX)                                                UR   24
      IER1=2                                                            UR   25
      GO TO 4                                                           UR   26
C***  WARNING                                                           UR   27
    3 IER1=1                                                            UR   28
C***  EXTRACT 'N'                                                       UR   29
    4 IER2=IER2-IBIT(IER1)                                              UR   30
C***  PRINT ERROR MESSAGE                                               UR   31
      WRITE (JWRITE,5) (ITYP(I,IER1),I=1,5),NAME,IER2,IER               UR   32
    5 FORMAT (1X,/,1X,'ERROR MESSAGE FROM UERTST',2X,5A4,4X,3A2,4X,I2,2X  UR   33
     1,'IER= ',I3)                                                      UR   34
      RETURN                                                            UR   35
      END


      SUBROUTINE VSORTM(A,LA)                                           VS    1
C                                                                       VS    2
C***  SUBROUTINE VSORTM SORTS ARRAYS BY ABSOLUTE VALUE                  VS    3
C                                                                       VS    4
      DIMENSION A(1),IU(21),IL(21)                                      VS    5
      REAL*8A,T,TT                                                      VS    6
C                                                                       VS    7
C***  FIND ABSOLUTE VALUES OF ARRAY A                                   VS    8
      DO 1 I=1,LA                                                       VS    9
      IF (A(I).LT.0.0)A(I)=-A(I)                                        VS   10
    1 CONTINUE                                                          VS   11
C                                                                       VS   12
      ENTRY VSORTA(A,LA)                                                VS   13
C                                                                       VS   14
C***  ENTRY VSORTA SORTS ARRAYS BY ALGEBRAIC VALUE                      VS   15
C                                                                       VS   16
      M=1                                                               VS   17
      I=1                                                               VS   18
      J=LA                                                              VS   19
      R=.375                                                            VS   20
    2 IF (I.EQ.J) GO TO 11                                              VS   21
      IF (R.GT..5898437) GO TO 4                                        VS   22
      R=R+3.90625E-2                                                    VS   23
      GO TO 5                                                           VS   24
    4 R=R-.21875                                                        VS   25
    5 K=I                                                               VS   26
C***  SELECT A CENTRAL ELEMENT OF THE ARRAY AND SAVE IT IN LOCATION T   VS   27
      IJ=I+(J-I)*R                                                      VS   28
      T=A(IJ)                                                           VS   29
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAT T, INTERCHANGE WITH T   VS   30
      IF (A(I).LE.T) GO TO 6                                            VS   31
      A(IJ)=A(I)                                                        VS   32
      A(I)=T                                                            VS   33
      T=A(IJ)                                                           VS   34
    6 L=J                                                               VS   35
C***  IF LAST ELEMENT OF ARRAY IS LESS THAN T, INTERCHANGE WITH T       VS   36
      IF (A(J).GE.T) GO TO 8                                            VS   37
      A(IJ)=A(J)                                                        VS   38
      A(J)=T                                                            VS   39
      T=A(IJ)                                                           VS   40
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAN T, INTERCHANGE WITH T   VS   41
      IF (A(I).LE.T) GO TO 8                                            VS   42
      A(IJ)=A(I)                                                        VS   43
      A(I)=T                                                            VS   44
      T=A(IJ)                                                           VS   45
      GO TO 8                                                           VS   46
    7 TT=A(L)                                                           VS   47
      A(L)=A(K)                                                         VS   48
      A(K)=TT                                                           VS   49
C***  FIND AN ELEMENT IN SECOND HALF OF ARRAY WHICH IS SMALLER THAN T   VS   50
    8 L=L-1                                                             VS   51
      IF (A(L).GT.T) GO TO 8                                            VS   52
C***  FIND AN ELEMENT IN FIRST HALF OF ARRAY WHICH IS GREATER THAN T    VS   53
    9 K=K+1                                                             VS   54
      IF (A(K).LT.T) GO TO 9                                            VS   55
C***  INTERCHANGE THESE ELEMENTS                                        VS   56
      IF (K.LE.L) GO TO 7                                               VS   57
C***  SAVE UPPER AND LOWER SUBSCRIPTS OF THE ARRAY YET TO BE SORTED     VS   58
      IF (L-I.LE.J-K) GO TO 10                                          VS   59
      IL(M)=I                                                           VS   60
      IU(M)=L                                                           VS   61
      I=K                                                               VS   62
      M=M+1                                                             VS   63
      GO TO 12                                                          VS   64
   10 IL(M)=K                                                           VS   65
      IU(M)=J                                                           VS   66
      J=L                                                               VS   67
      M=M+1                                                             VS   68
      GO TO 12                                                          VS   69
C***  BEGIN AGAIN ON ANOTHER PORTION OF UNSORTED ARRAY                  VS   70
   11 M=M-1                                                             VS   71
      IF (M.EQ.0) RETURN                                                VS   72
      I=IL(M)                                                           VS   73
      J=IU(M)                                                           VS   74
   12 IF (J-I.GE.11) GO TO 5                                            VS   75
      IF (I.EQ.1) GO TO 2                                               VS   76
      I=I-1                                                             VS   77
```

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```
13 J=I+1                                                        VS   78
   IF (I.EQ.J) GO TO 11                                         VS   79
   T=A(I+1)                                                     VS   80
   IF (A(I).LE.T) GO TO 13                                      VS   81
   K=I                                                          VS   82
14 A(K+1)=A(K)                                                  VS   83
   K=K-1                                                        VS   84
   IF (T.LT.A(K)) GO TO 14                                      VS   85
   A(K+1)=T                                                     VS   86
   GO TO 13                                                     VS   87
   END                                                          VS   88
```

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Flowchart — MDLCK

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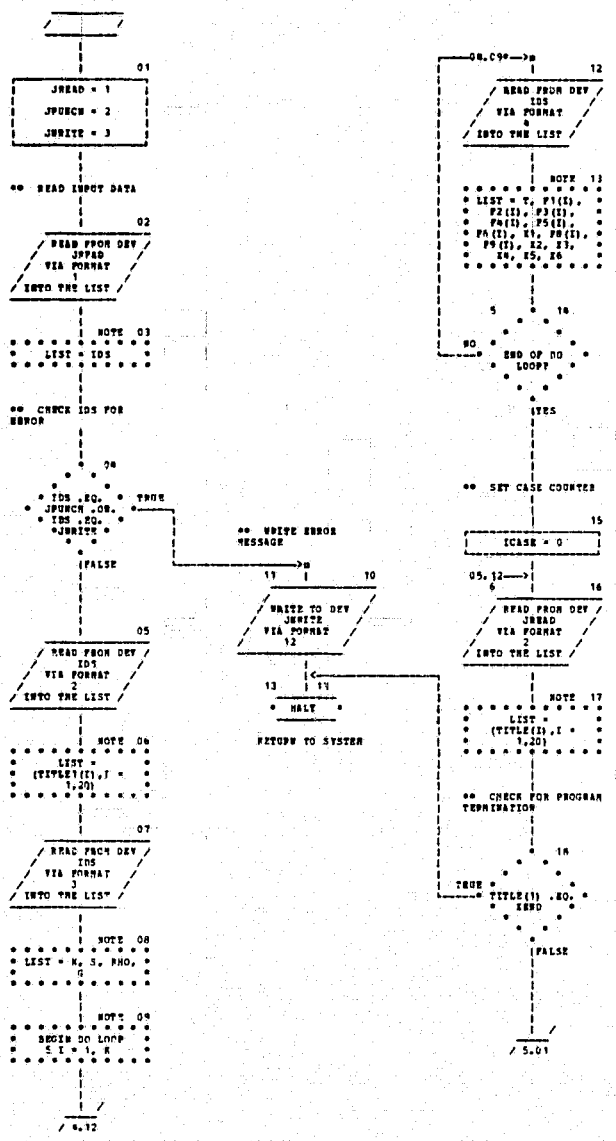
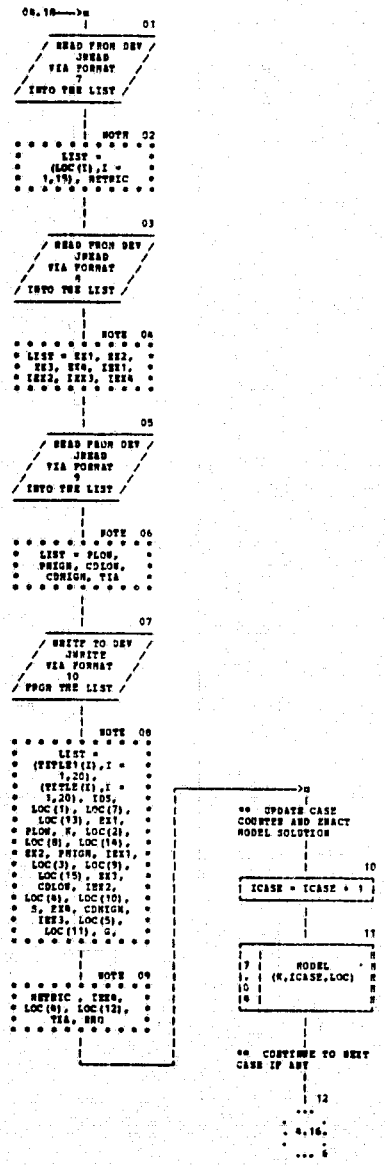


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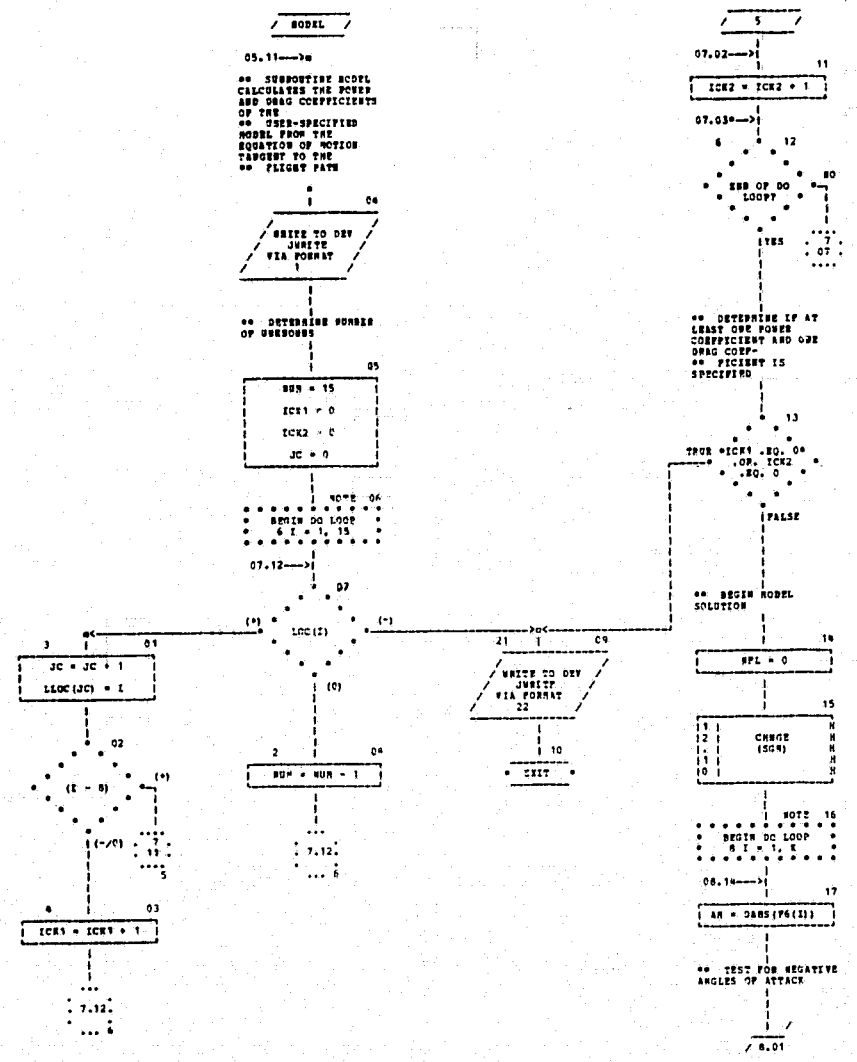
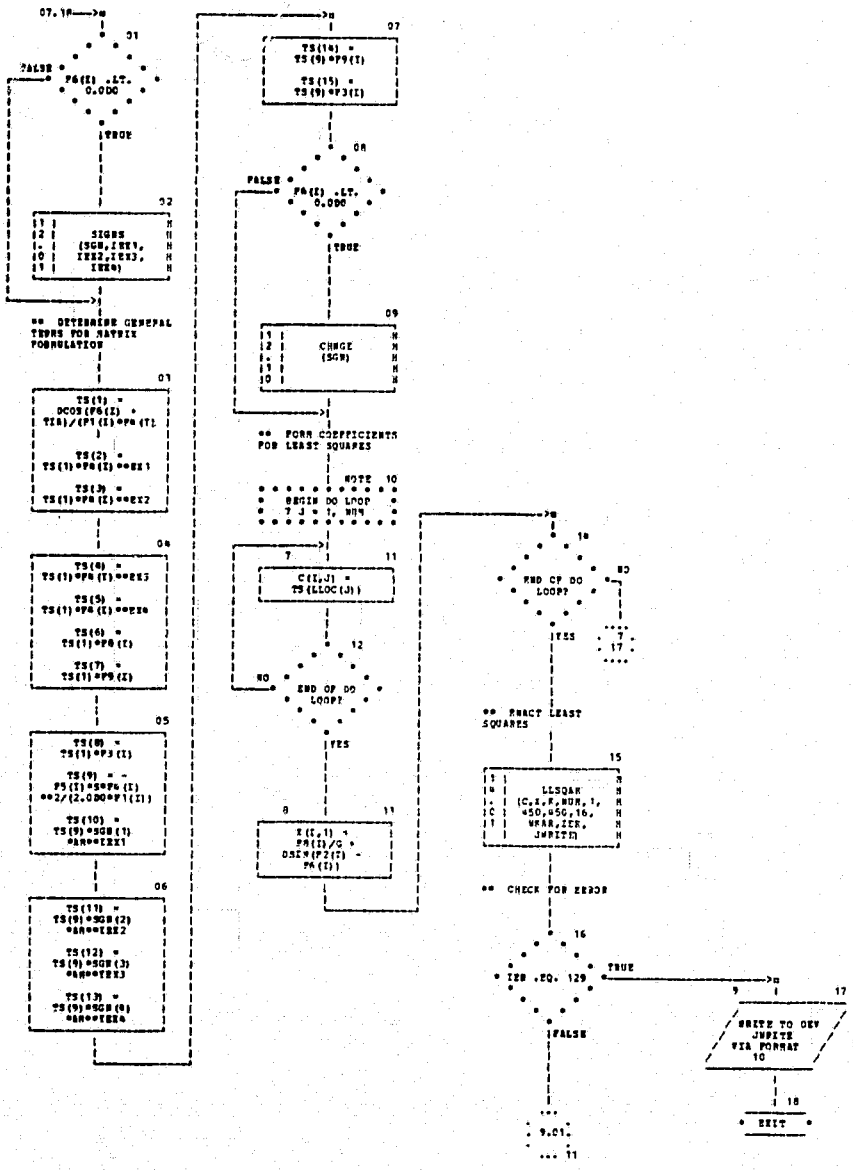


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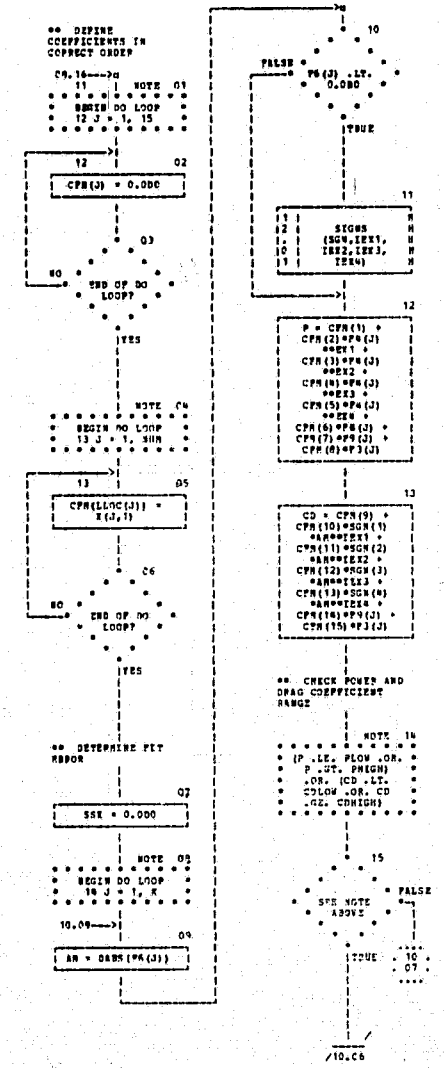
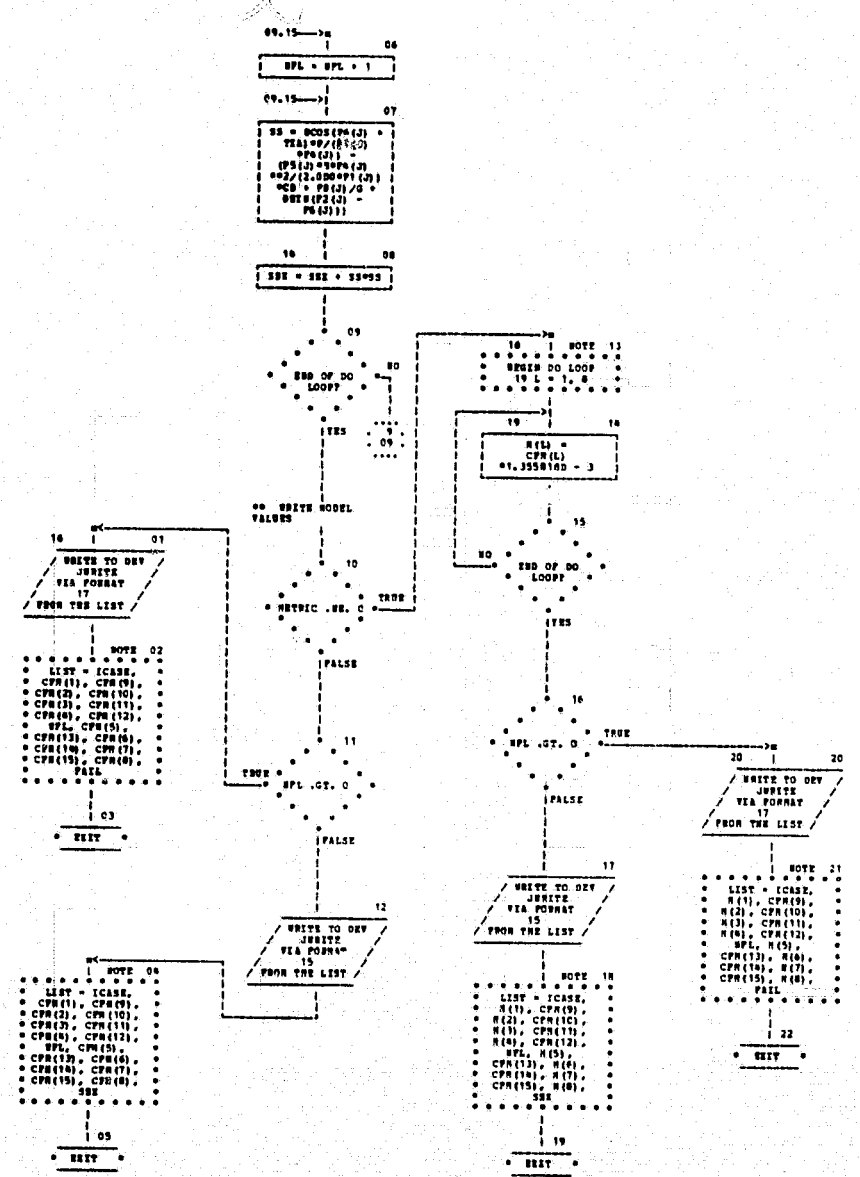


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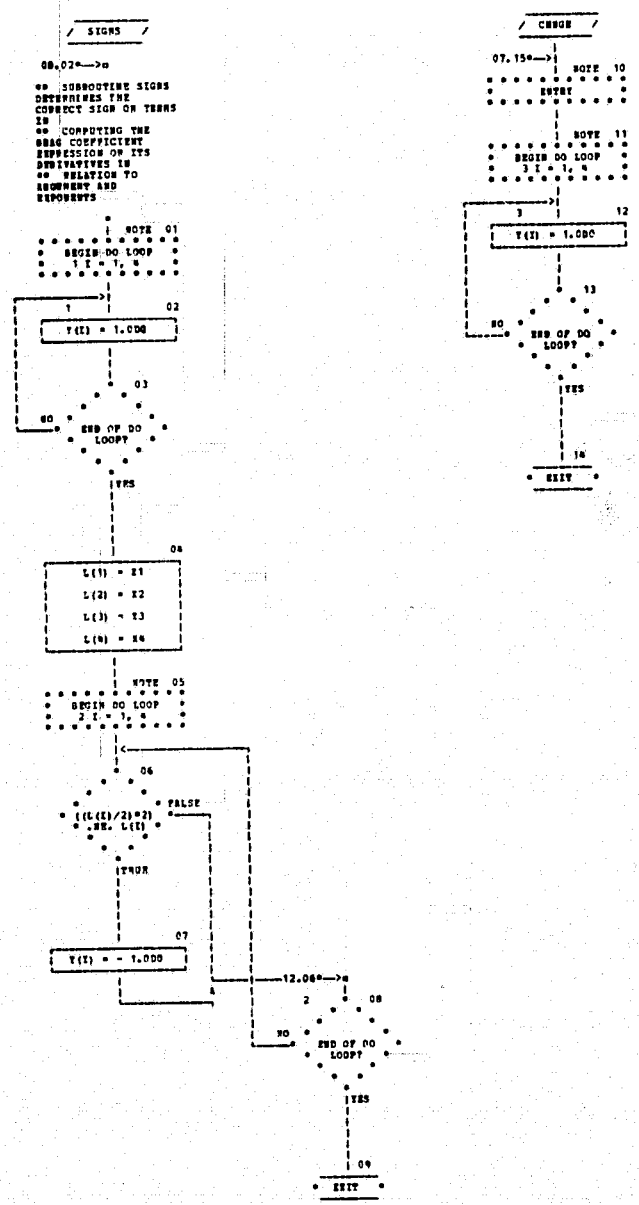
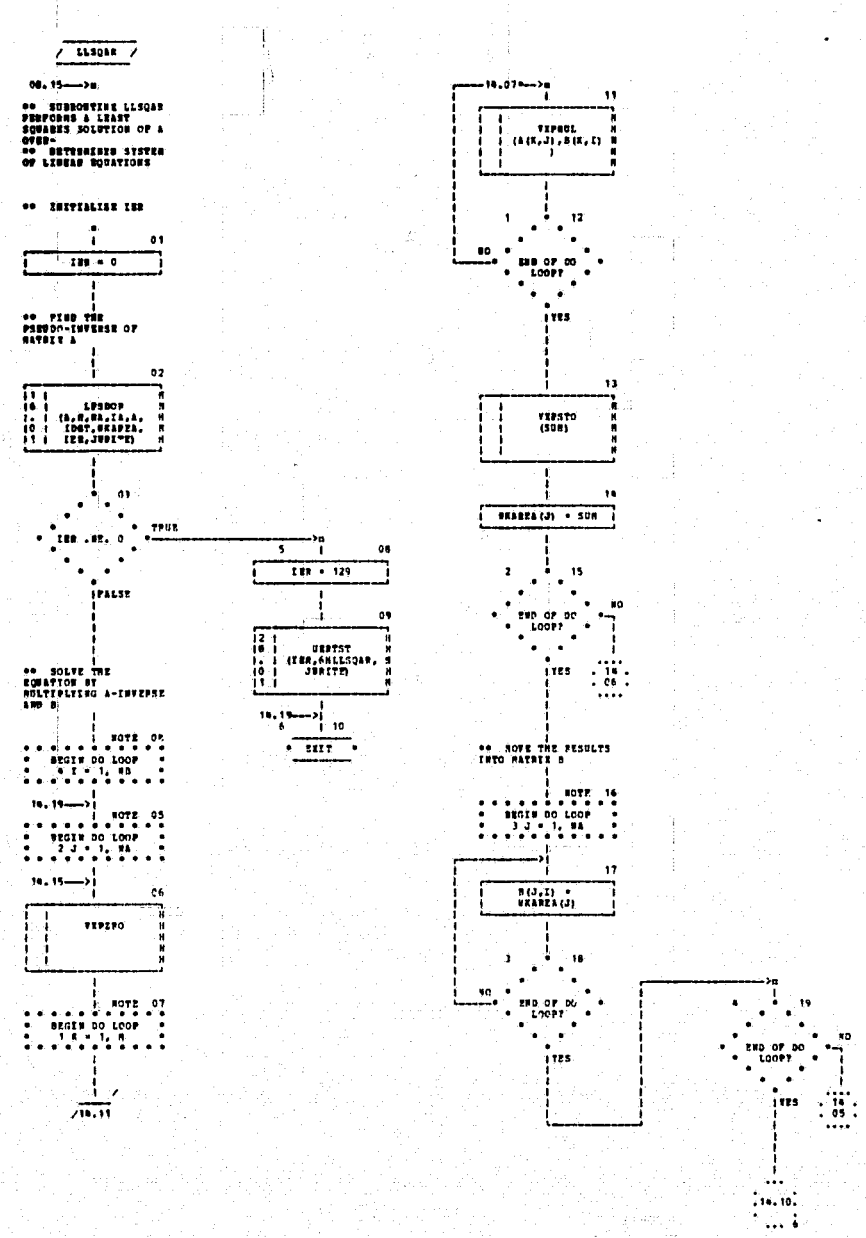
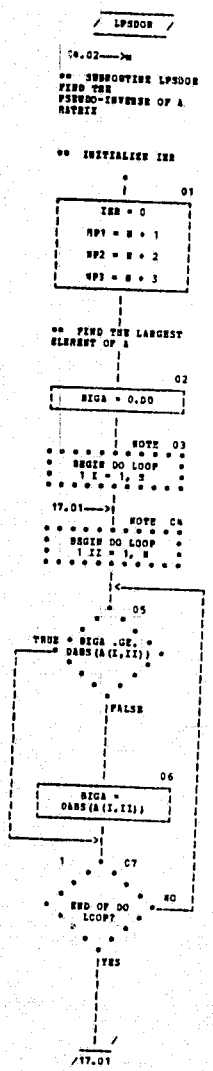


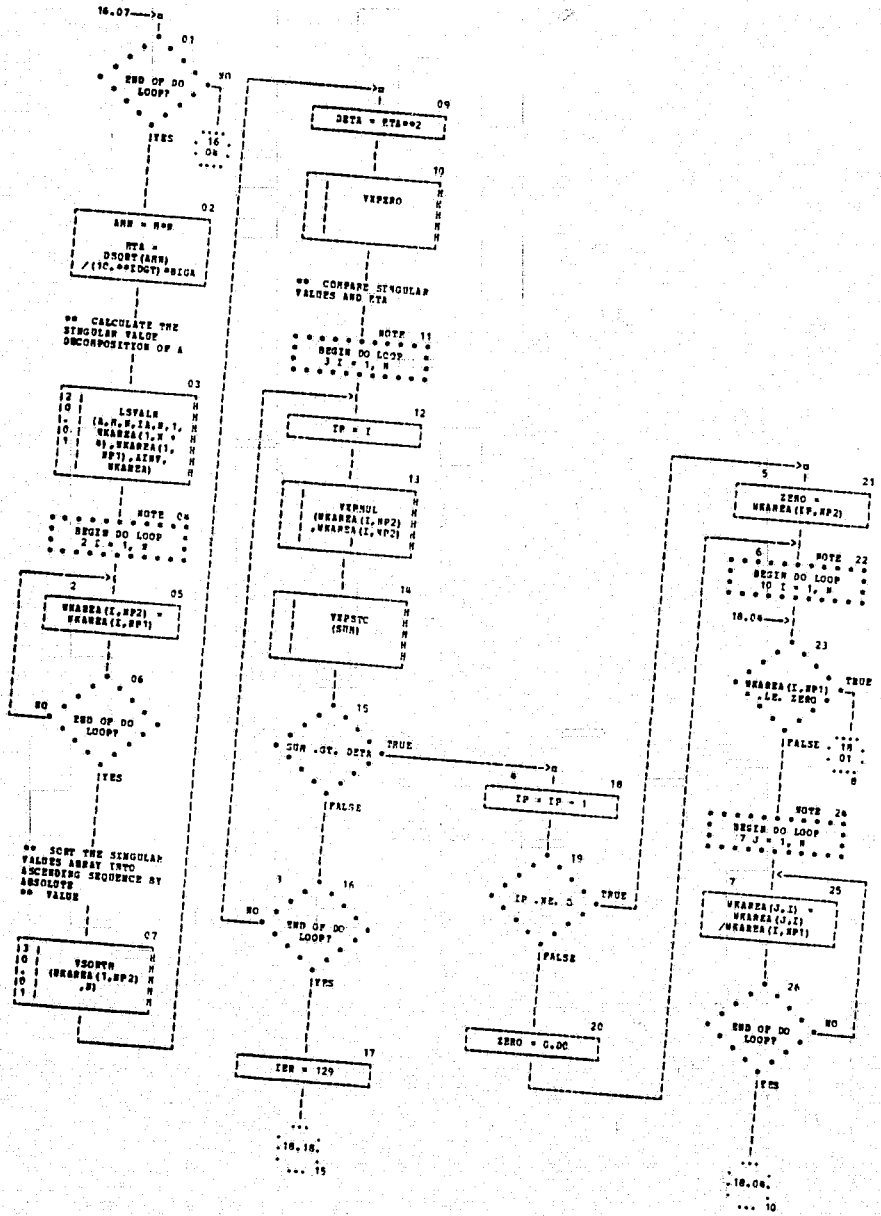
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CHART TITLE - SUBROUTINE LPSDOR(A,B,N,IA,AINV,IDGT,WORKA,IER,JOBITR)




16.07
01
END OF DO LOOP?
NO
YES
16.08
02
ANN = N**2
ETA = DSORT(ANN) / (10.**DIGIT)*BIGA
** CALCULATE THE SINGULAR VALUE DECOMPOSITION OF A
03
LSVALR (A,M,N,IA,0,1, WKAREA(1,N+1), WKAREA(1,NP1),AINV, WKAREA)
NOTE 04
BEGIN DO LOOP I = 1, N
2
05
WKAREA(I,NP2) = WKAREA(I,NP1)
06
END OF DO LOOP?
NO
YES
** SORT THE SINGULAR VALUES ARRAY INTO ASCENDING SEQUENCE BY ABSOLUTE
** VALUE
07
VSORTR (WKAREA(1,NP2),N)
09
BETA = ETA**2
10
VKPERO
** COMPARE SINGULAR VALUES AND ETA
NOTE 11
BEGIN DO LOOP I = 1, N
12
IP = I
13
VKPMUL (WKAREA(I,NP2),WKAREA(I,NP2))
14
VKPSTC (SUM)
15
SUM .GT. BETA?
TRUE
FALSE
3
16
END OF DO LOOP?
NO
YES
17
IER = 129
18.18.
... 15
8
18
IP = IP + 1
19
IP .NE. I?
TRUE
FALSE
20
ZERO = 0.0D
5
21
ZERO = WKAREA(IP,NP2)
6
NOTE 22
BEGIN DO LOOP I = 1, N
18.04
23
WKAREA(I,NP1) .LE. ZERO?
TRUE
FALSE
18.01
8
NOTE 24
BEGIN DO LOOP J = 1, N
7
25
WKAREA(J,I) = WKAREA(J,I) /WKAREA(I,NP1)
26
END OF DO LOOP?
NO
YES
18.06.
... 10

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CHART TITLE - SUBROUTINE LRDCR(A,M,N,IA,AINV,IPGT,WKAREA,IER,JWRITE)

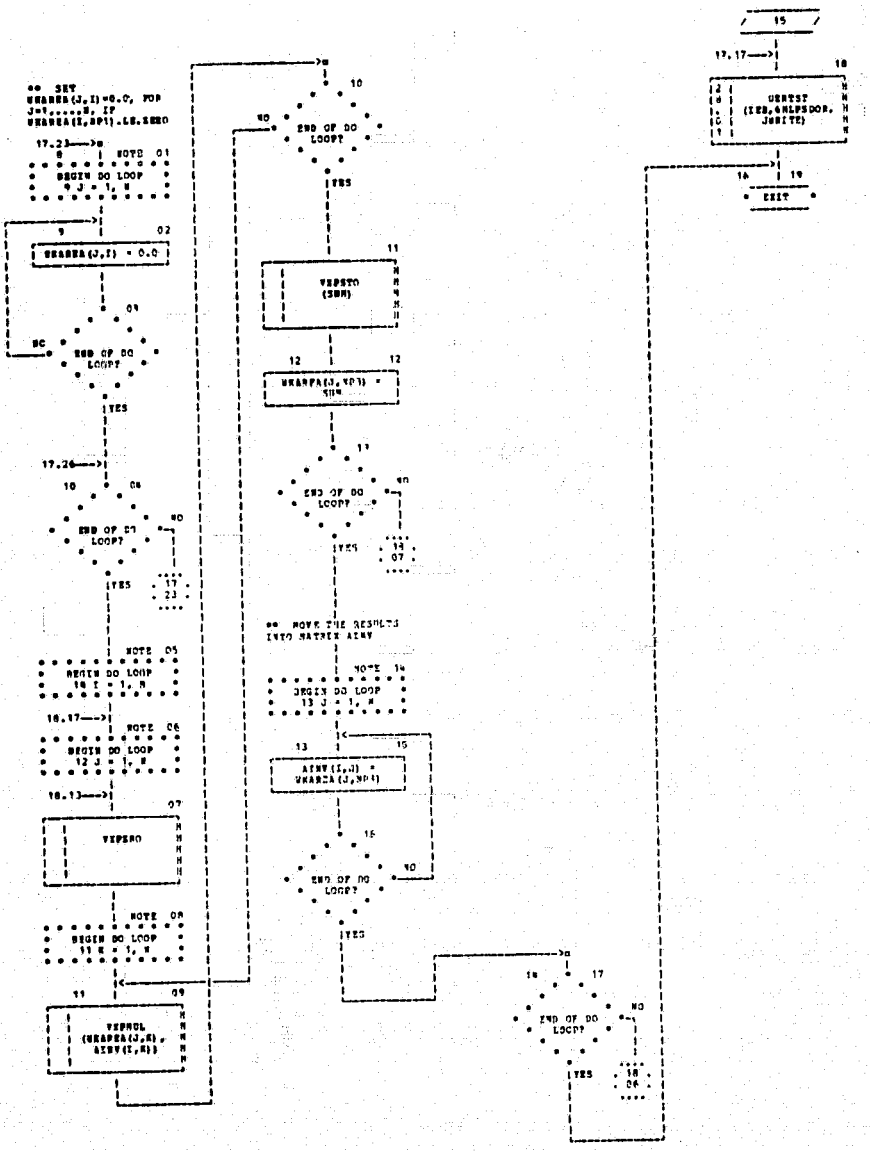
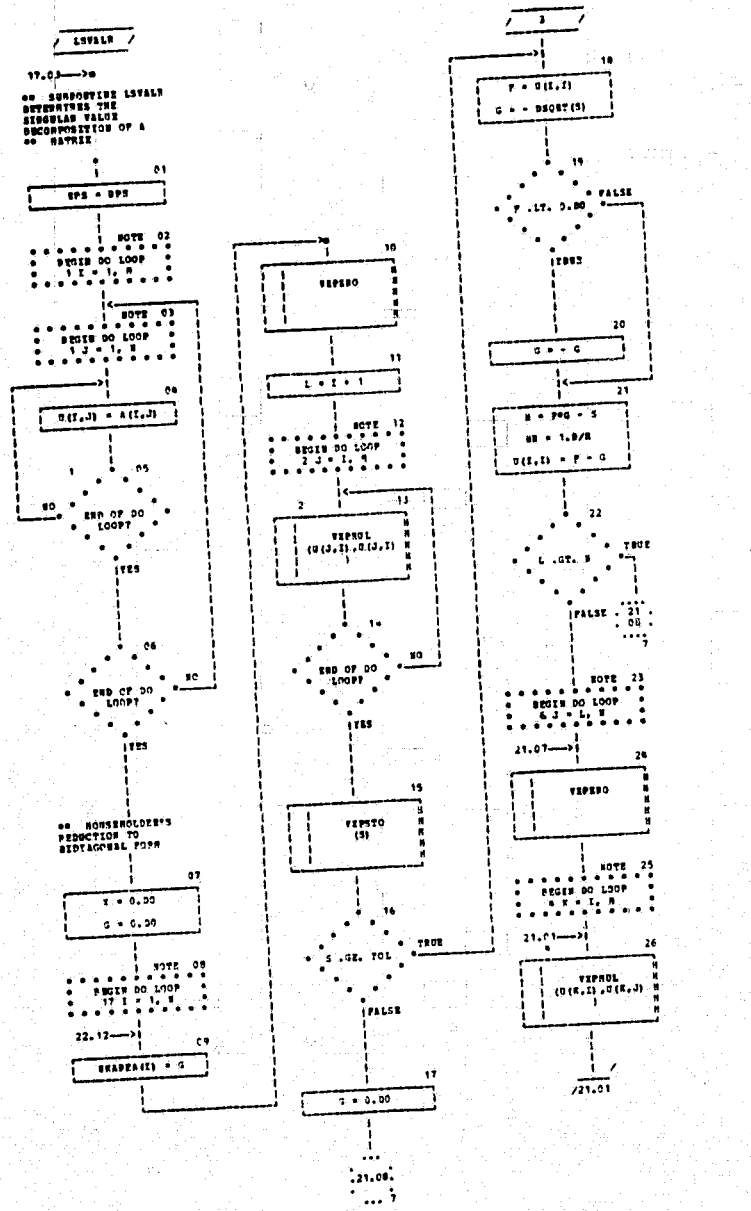


CHART TITLE - SUBROUTINE LSVALS(A,M,N,IA,IV,ISW,WKAREA,Q,U,V)



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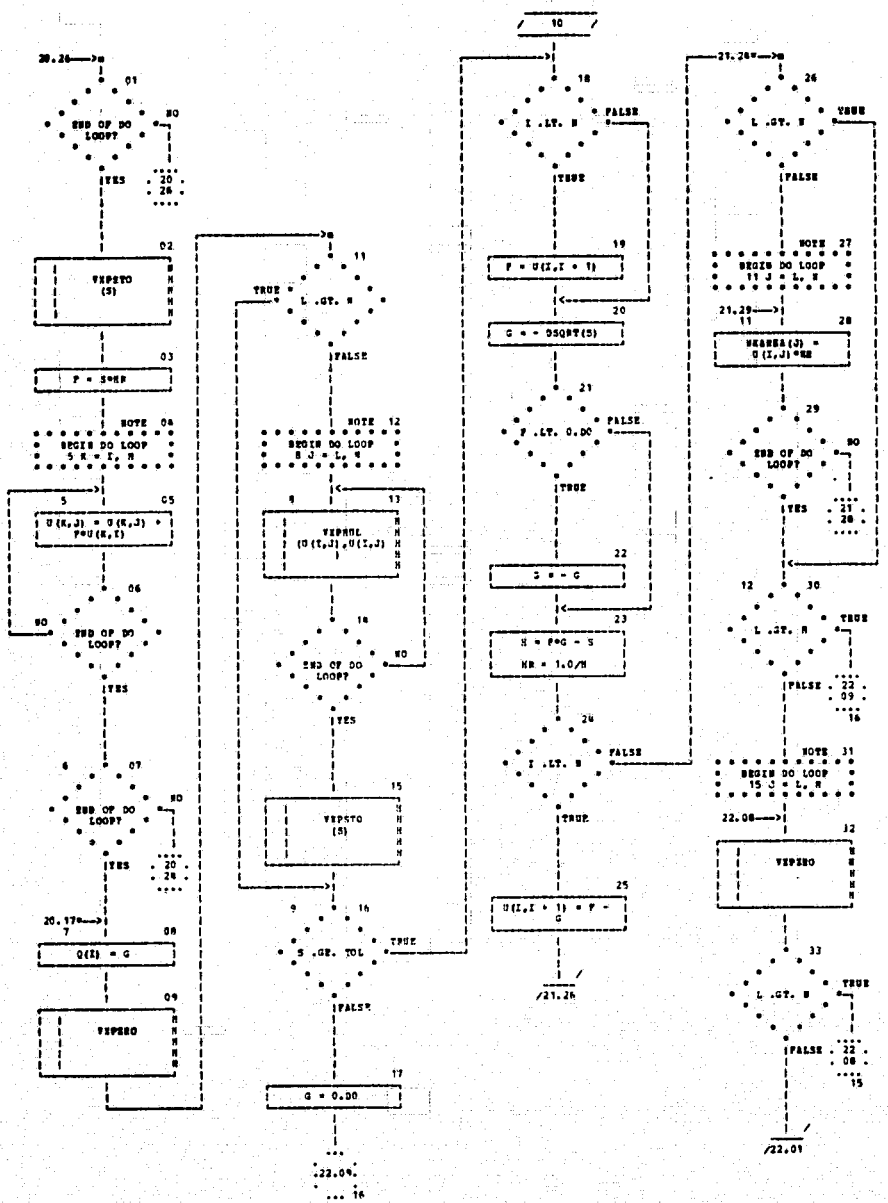
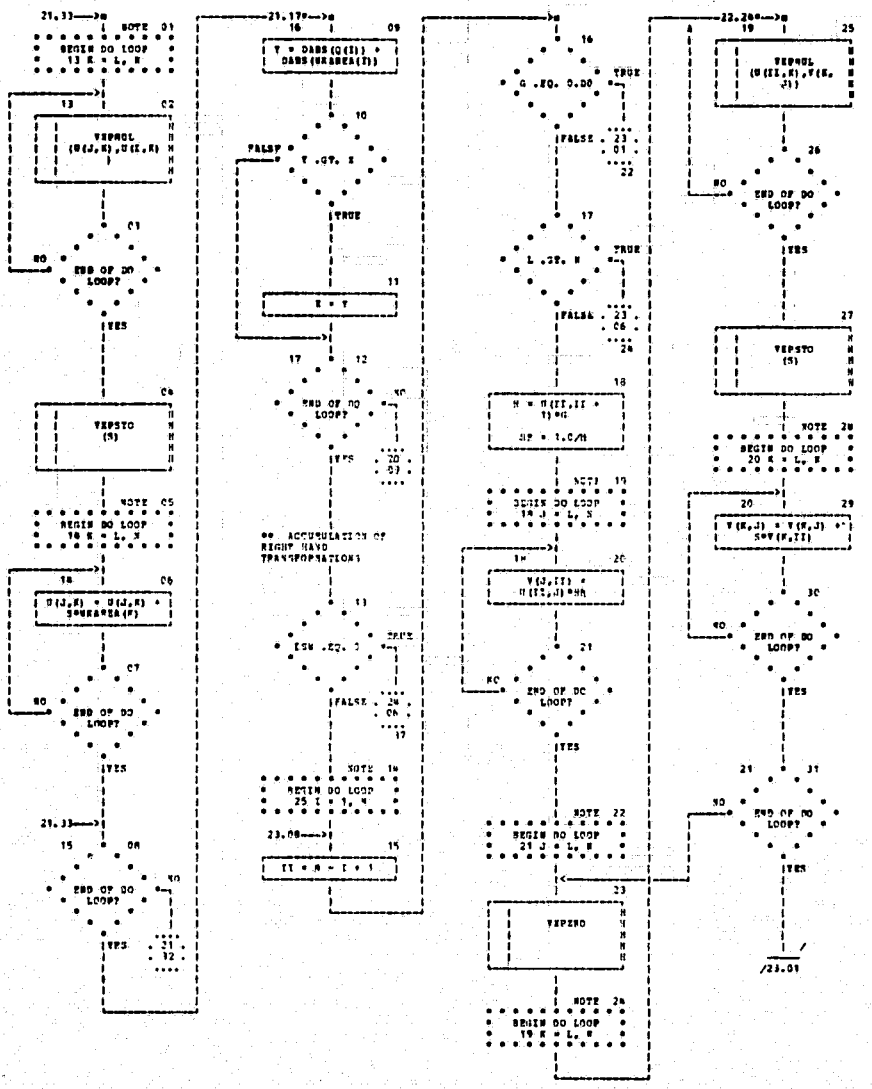


CHART TITLE - SUBROUTINE LSVALS(A,M,N,IA,IV,ISW,NAREA,Q,U,V)



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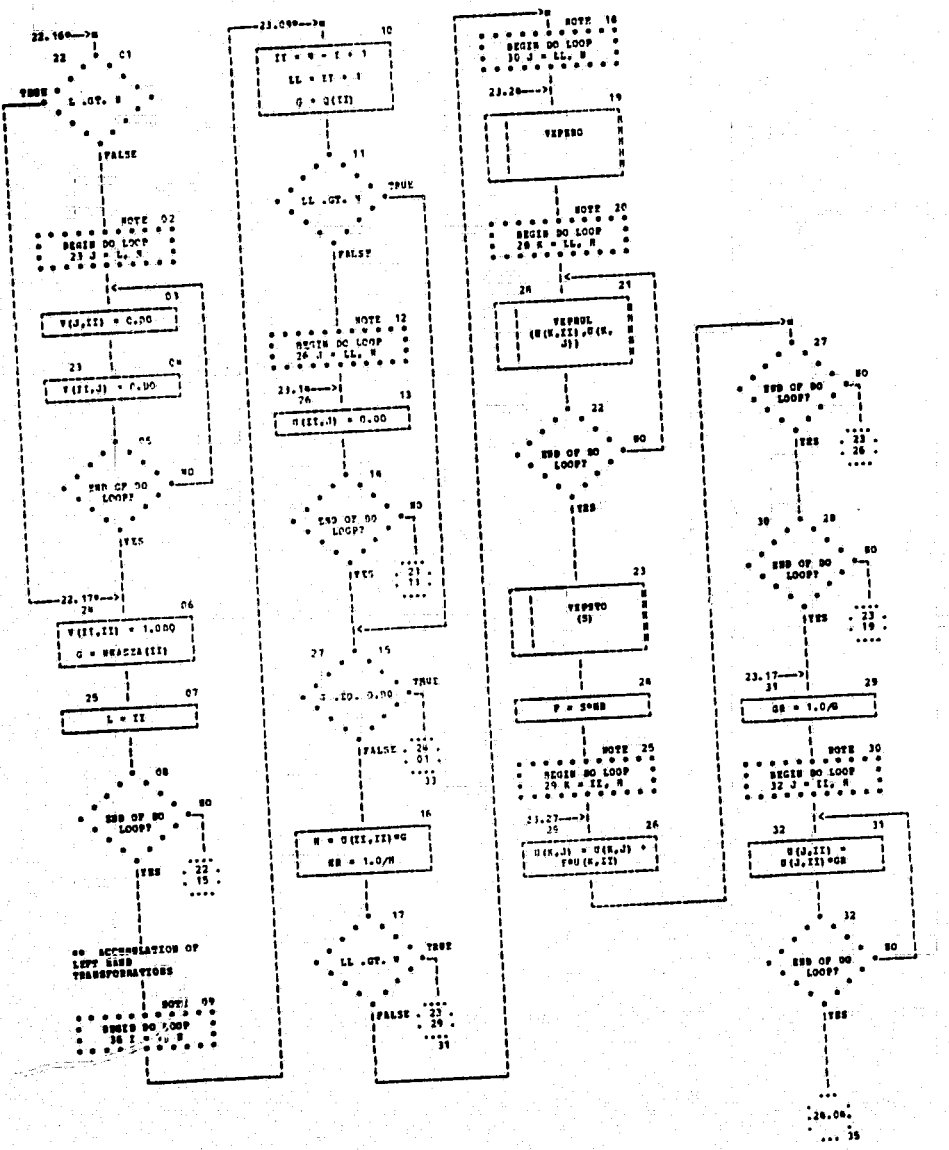
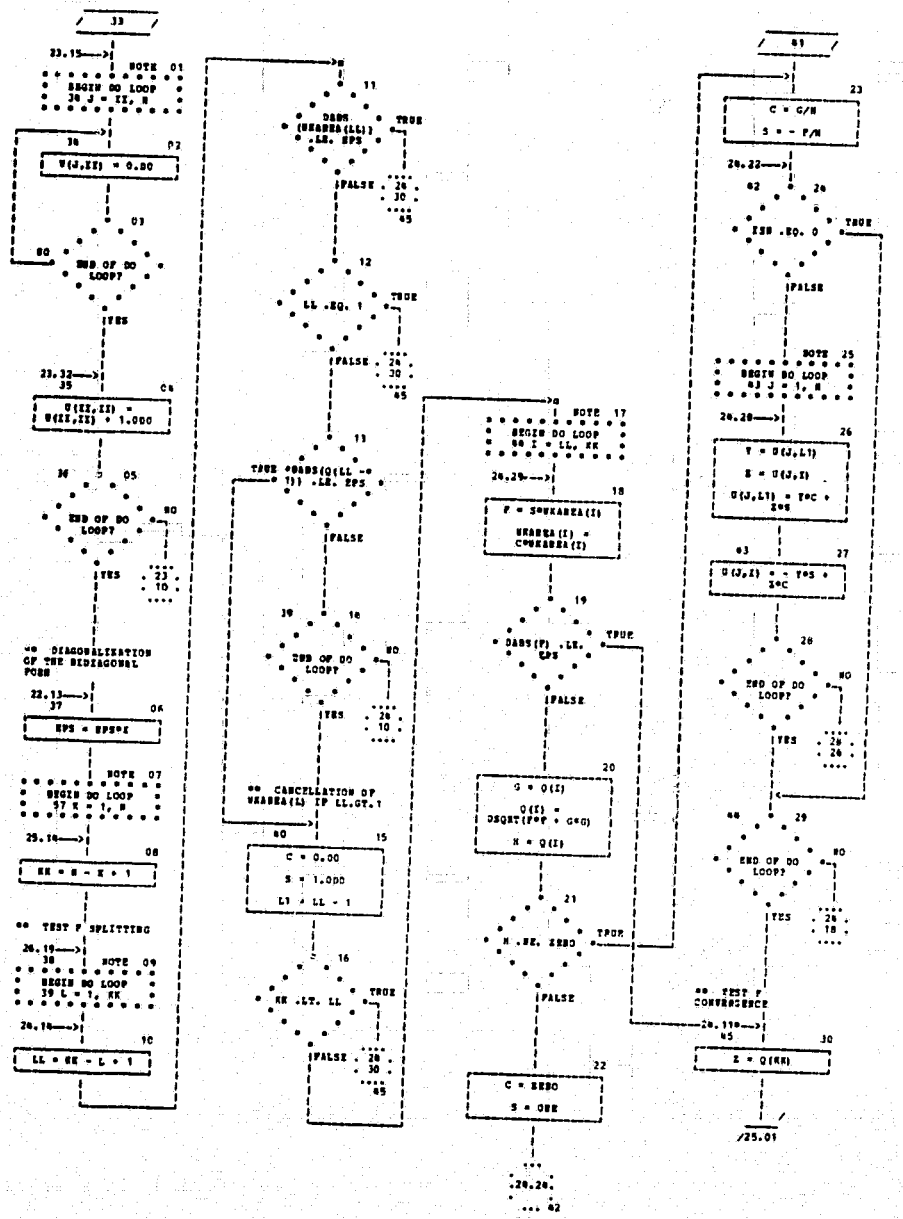


CHART TITLE - SUBROUTINE LSVALS(A,B,D,IA,IV,ISW,WEABEA,Q,U,V)



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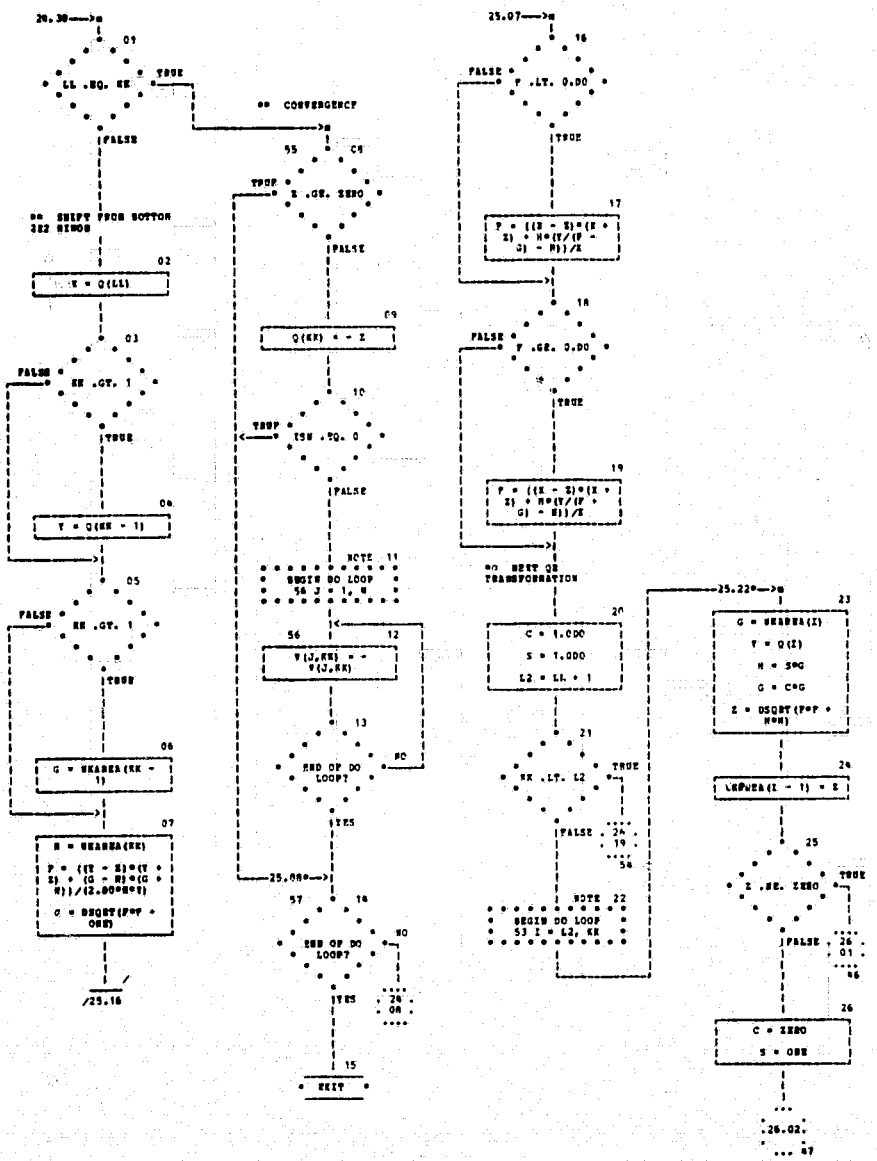
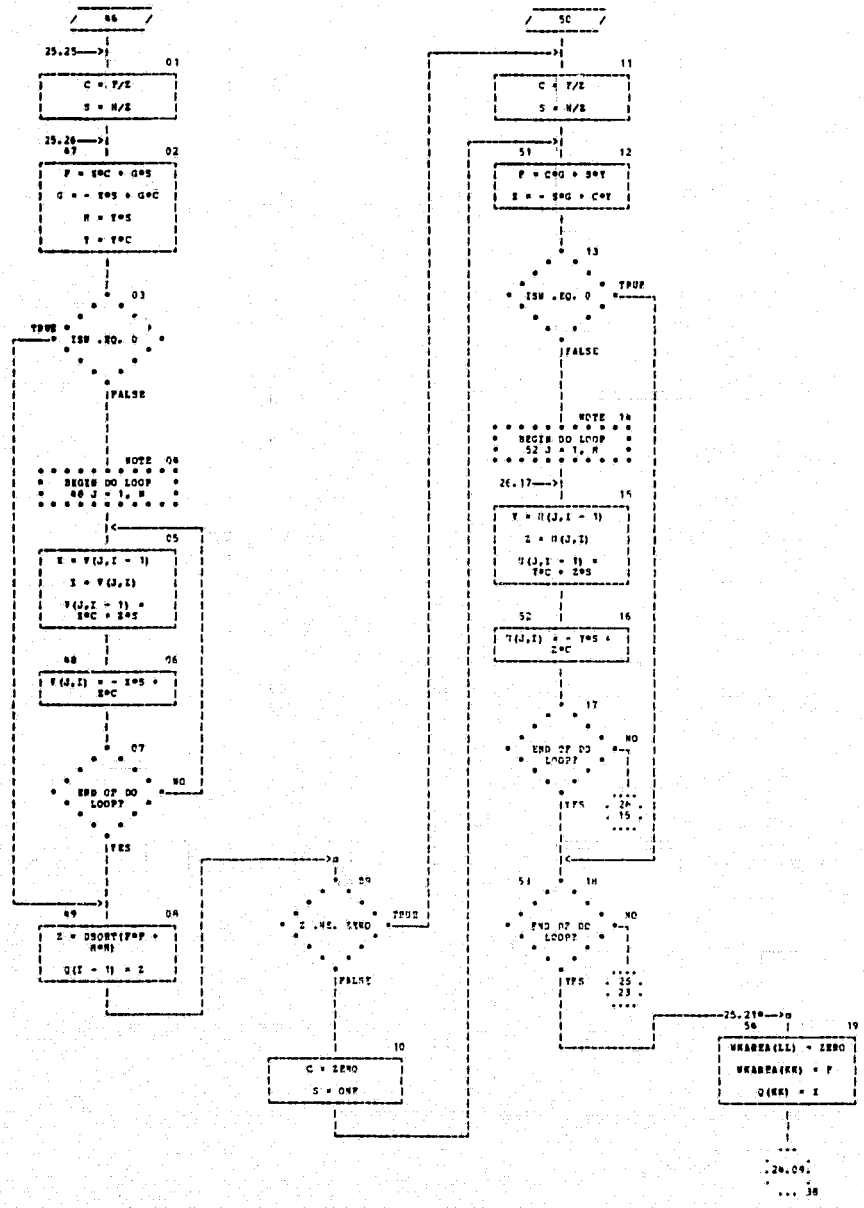


CHART TITLE - SUBROUTINE LSVALS(A,M,N,IA,IV,ISW,WKAREA,Q,U,V)



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CHART TITLE - SUBROUTINE GENTST(IER,NAME,JUNITY)

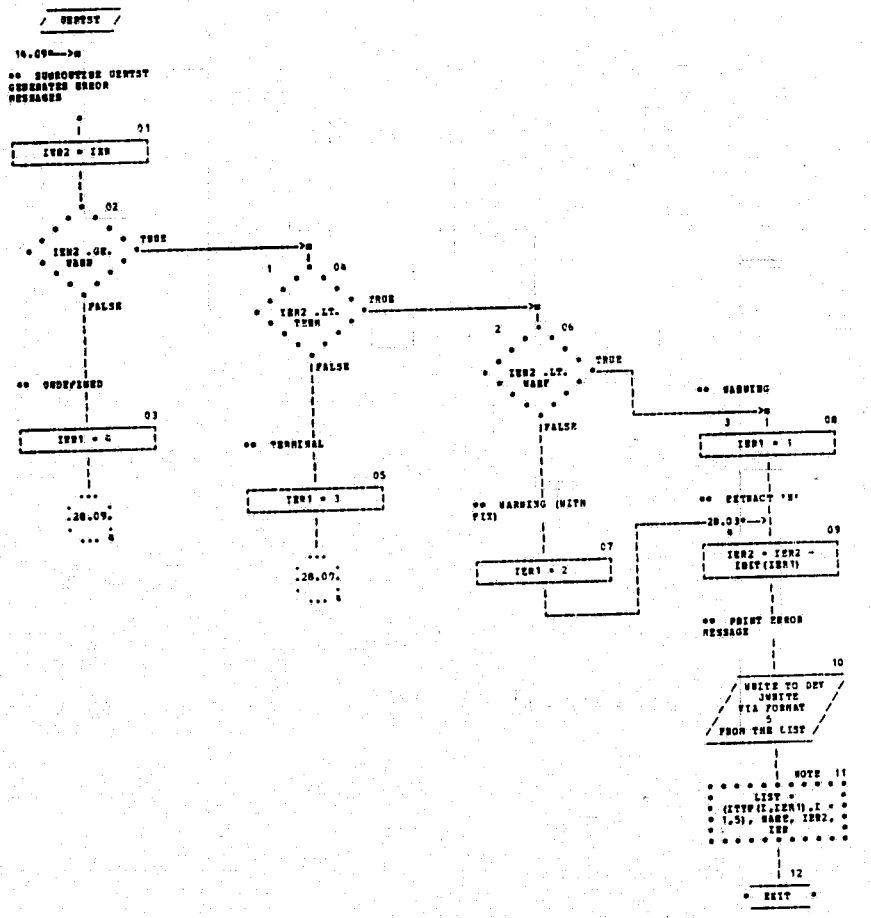
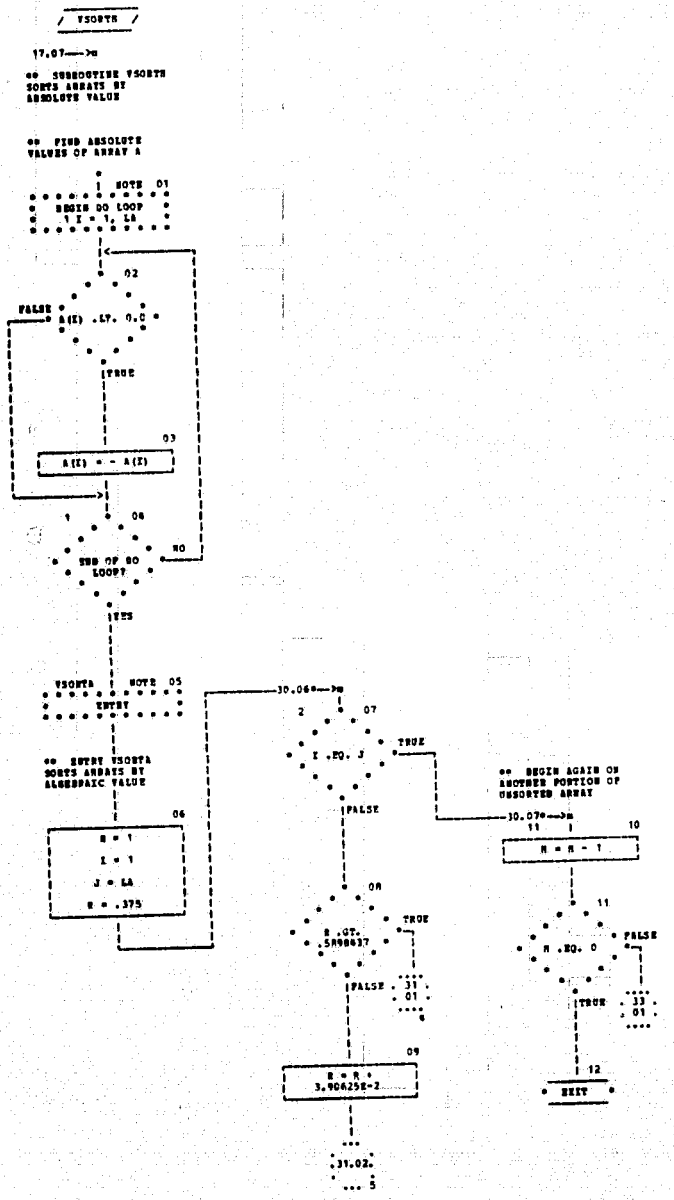


CHART TITLE - SUBROUTINE VSORTA(A,LA)



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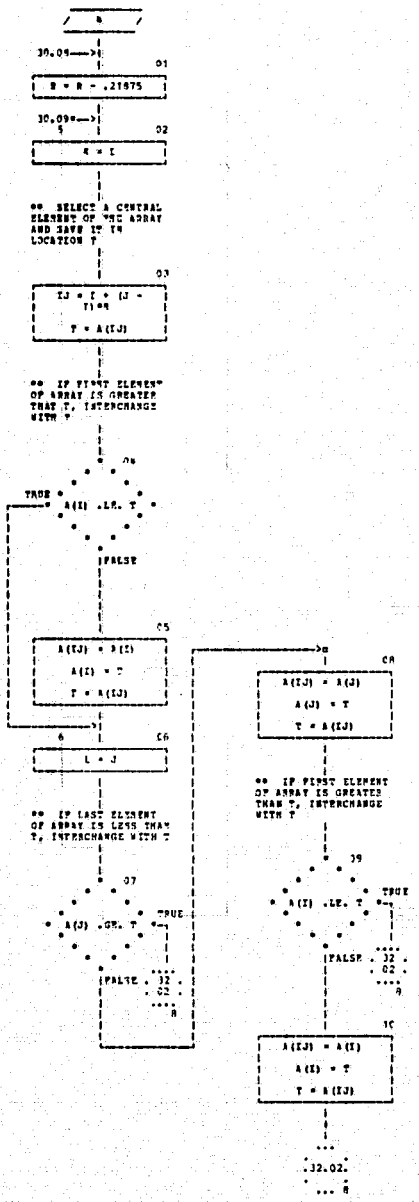
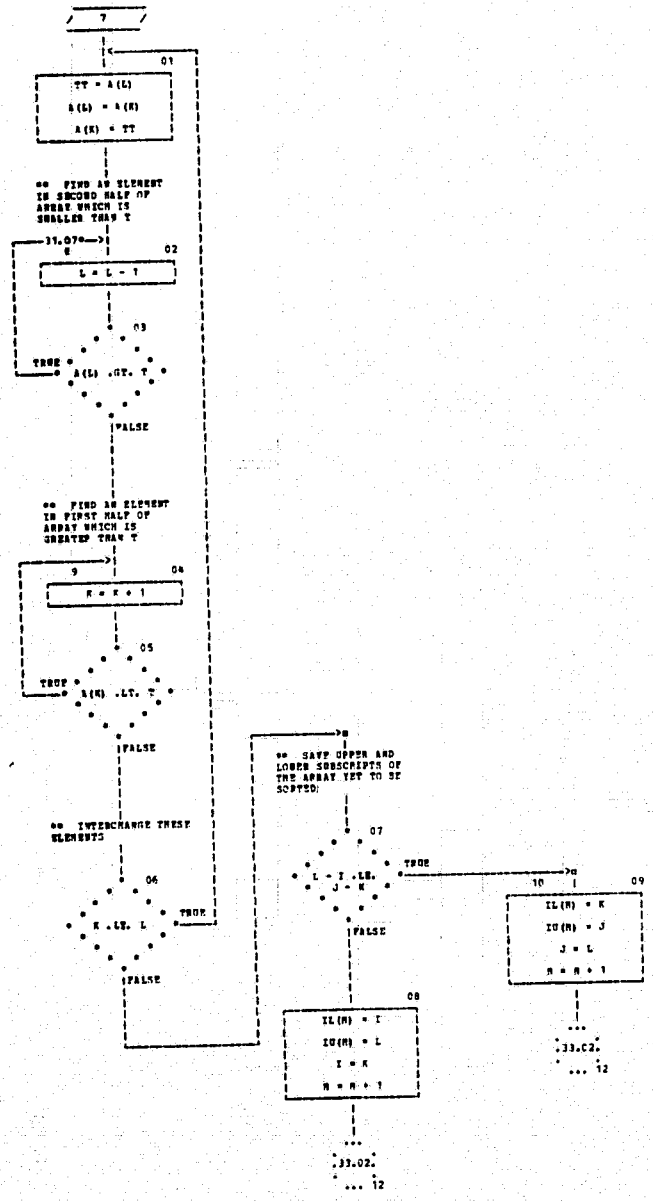
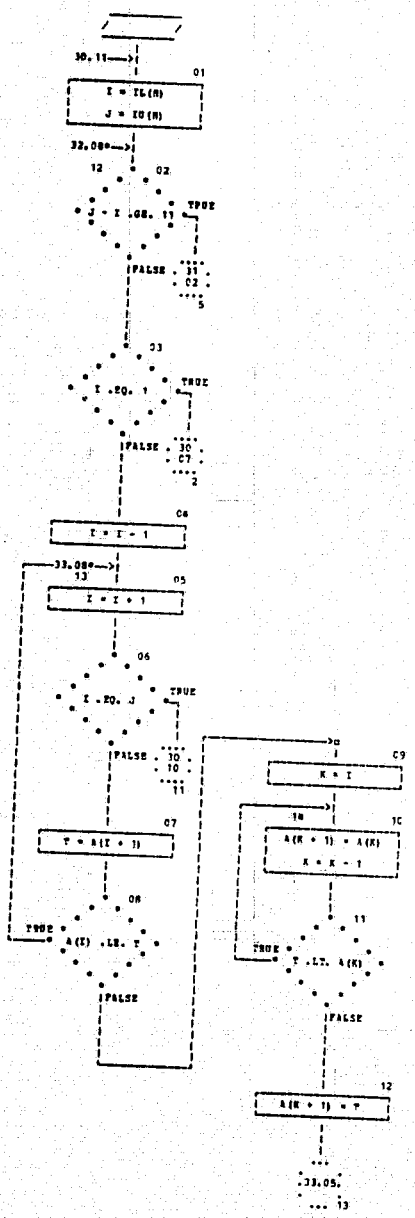


CHART TITLE - SUBROUTINE *SORTR(A,LA)



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Sample Input — MDLCK

```
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
  1    1
  1
  1
 ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
      129 0.15500000D 03 0.23780000D-02 0.32200000D 02 0.32800000D 02
 0.0                     0.3971508235920000D 04  -0.1449845059087610D-03
 0.8206444800771690D-03  0.2556077542975478D 03   0.1687264989317283D-02
 0.3250327240193279D-01  0.4912399180312723D 03   0.1983237149511043D 00
-0.4627564675544772D-02  0.1128177046685848D 05  -0.8237792807931728D 01
 0.1253732616409635D 01  0.0                      0.0
 0.1000000000058208D 00  0.3971505000630000D 04  -0.7882911261549059D-04
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 0.1199541993109372D-02  0.1127638609405062D 05  -0.7062914605268120D 01
 0.1948078838767342D 01  0.0                      0.0
 0.8000000000029104D 00  0.3971482353600000D 04   0.4076422468851899D-02
 0.7654377927456844D-02  0.2557590139661420D 03   0.1687590001988585D-02
 0.3141596137572036D-01  0.4914679220088727D 03   0.1615194209970229D 00
 0.1933368194790177D-02  0.1127568956385663D 05  -0.6867661235320520D 01
 0.1953334415726577D 01  0.0                      0.0
 0.9000000000087311D 00  0.3971479118310000D 04   0.5080851007948148D-02
 0.8268686476209753D-02  0.2557745635492901D 03   0.1687626190540451D-02
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 0.1928080148084260D 01  0.0                      0.0
 0.1000000000000000D 01  0.3971475883020000D 04   0.6129494024458293D-02
 0.8724328249723167D-02  0.2557888543452904D 03   0.1687661350490023D-02
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 0.29400000000000870 02  0.39705570606600000 04  0.73539416242020D-02
 0.97869740792167040-02  0.25403713851408430 03  0.16853621420275620-02
 0.39136572331957530-01  0.49070044368853440 03  0.41693898323108470 00
-0.51595404881539240-02  0.11317390242703290 05 -0.80629658804786580 01
 0.34974000875709020 01  0.0                     0.0
 0.29500000000000000 02  0.39705538253700000 04  0.81841672310131540-02
 0.93957190024715010-02  0.25407707733490950 03  0.16854042837104250-02
 0.38650821347182410-01  0.49070928647186990 03  0.38166433708173150 00
-0.45500744986172180-02  0.11316601051013010 05 -0.77247054280580870 01
 0.32671600318187860 01  0.0                     0.0
 0.29600000000000820 02  0.39705505900800000 04  0.89863276946805780-02
 0.90317032957129970-02  0.25411356779223610 03  0.16854446817201870-02
 0.38227386641680950-01  0.49071878396026900 03  0.34882096611497080 00
-0.39157694772197760-02  0.11315844527447090 05 -0.74096676815710230 01
 0.30330671653685610 01  0.0                     0.0
 0.29699999999997090 02  0.39705473547900000 04  0.97613502837671500-02
 0.86853669204980650-02  0.25414689231043490 03  0.16854834605926150-02
 0.37867968544049490-01  0.49072905956536750 03  0.31833645095100500 00
-0.32724545644312180-02  0.11315118331809140 05 -0.71181967366015900 01
 0.27959868613245650 01  0.0                     0.0
 0.29800000000000290 02  0.39705441195000000 04  0.10508714538743790-01
 0.83471568272742910-02  0.25417728244222380 03  0.16855207478048420-02
 0.37572644725097770-01  0.49074031896611280 03  0.29014095053547140 00

-0.26366774487265320-02  0.11314420094300730 05 -0.68505356915180760 01
 0.25570747777958350 01  0.0                     0.0
 0.29900000000000870 02  0.39705480842100000 04  0.11226588769468020-01
 0.80078157833169250-02  0.25420496474666360 03  0.16855566697983350-02
 0.37339821604839870-01  0.49075178417639600 03  0.26416658819435660 00
-0.20252358059102960-02  0.11313784726949300 05 -0.66068014661645050 01
 0.23176941059198340 01  0.0                     0.0
 0.30000000000000000 02  0.39705376489200000 04  0.11911912840256690-01
 0.76586521785367460-02  0.25423020113854320 03  0.16855913545959810-02
 0.37166233463200230-01  0.49076407245447450 03  0.24034657860428690 00
-0.14546932982777420-02  0.11313097937318190 05 -0.63869625470033440 01
 0.20794406197260820 01  0.0                     0.0
 0.30100000000005820 02  0.39705384136300000 04  0.12560523870125320-01
 0.72917870810015860-02  0.25425316128928440 03  0.16856249293068080-02
 0.37046990336101470-01  0.49077719385025670 03  0.21861634244248190 00
-0.94988946358361620-03  0.11312469284414400 05 -0.61908184969488620 01
 0.18440945389027660 01  0.0                     0.0
 0.30199999999997090 02  0.39705311783400000 04  0.13167322339610070-01
 0.69003739985662190-02  0.25427400673216530 03  0.16856575194789160-02
 0.36975674818613840-01  0.49079086719042830 03  0.19890267425536020 00
-0.49885340388920960-03  0.11311858996352560 05 -0.60179861626201050 01
 0.16135226122380000 01  0.0                     0.0
 0.30300000000000290 02  0.39705279830500000 04  0.13726475457857320-01
 0.64787908289193500-02  0.25429297905694290 03  0.16856892481181420-02
 0.36944486862043980-01  0.49080548950923140 03  0.18114324774487040 00
-0.14033211298714040-03  0.11311264888909085D 05 -0.58678901379973360 01
 0.13869625882598910 01  0.0                     0.0
 0.30400000000000870 02  0.39705247077600000 04  0.14231653033836280-01
 0.60228021984275300-02  0.25431026920382250 03  0.16857202346342760-02
 0.36944434511040260-01  0.49082058257145470 03  0.16526662755667690 00
 0.12265454204518630-03  0.11311068468607440 05 -0.57397551207222930 01
 0.11746308615080350 01  0.0                     0.0
 0.30500000000000000 02  0.39705214724700000 04  0.14676290561539420-01
 0.55296921409685690-02  0.25432606301527160 03  0.16857505937649080-02
 0.36965567262788730-01  0.49083720370900580 03  0.15120270914305760 00
 0.28221894219804250-03  0.11310116238372150 05 -0.56326044954620330 01
 0.97032995982652180 00  0.0                     0.0
 0.30600000000000820 02  0.39705182371800000 04  0.15053873086056590-01
 0.49983670435119890-02  0.25434058140480210 03  0.16857804345078790-02
 0.36997247351225080-01  0.49085382697353550 03  0.13888159471467530 00
 0.33295664287980030-03  0.11309557504652070 05 -0.55452633956891190 01
 0.77975214165692340 00  0.0                     0.0
 0.30699999999997090 02  0.39705150018900000 04  0.15358232653970010-01
 0.44294287918195400-02  0.25435395277433250 03  0.16858098590750350-02
 0.37028452794152810-01  0.49087110751613620 03  0.12823476888905650 00
 0.27262820604789790-03  0.11309005705758300 05 -0.54763648943643500 01
 0.60178110296311620 00  0.0                     0.0
 0.30800000000002910 02  0.39705117666000000 04  0.15583851423358810-01
 0.38252177283107830-02  0.25436629733755670 03  0.16858389618920430-02
 0.37048810454993450-01  0.49088953133655630 03  0.11919627914361710 00
 0.10235714784223580-03  0.11308461668424910 05 -0.54243600575441630 01
 0.44113493812244540 00  0.0                     0.0
 0.30900000000000870 02  0.39705085313100000 04  0.15726161910864530-01
 0.31898245047712370-02  0.25437781571199150 03  0.16858678286766150-02
 0.37045408694977380-01  0.49090878660055180 03  0.11170367191125880 00
-0.17326974056053320-03  0.11307921192521410 05 -0.53875376004954210 01
 0.29838295495966350 00  0.0                     0.0
 0.31000000000000000 02  0.39705052960200000 04  0.15781835412832790-01
 0.25290692518577430-02  0.25438868787077330 03  0.16858965356006240-02
 0.37010203256771250-01  0.49092809937672440 03  0.10569843253156340 00
```

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-0.5462113017902225D-03   0.113073837167277OD 05  -0.5364036312141366D 01
 0.1749206024549039D 00   0.0                      0.0
 0.3110000000000582D 02   0.3970502060730000D 04   0.1574904936989140D-01
 0.1850445818666640D-02   0.2543989733527804D 03   0.1685925148549482D-02
 0.3693329833097623D-01   0.4909489244801701D 03   0.1011256660100415D 00
-0.1005098470197252D-02   0.1130684807387703D 05  -0.5351867755436729D 01
 0.7190111723929250D-01   0.0                      0.0
 0.3119999999997709D 02   0.3970498825440000D 04   0.1562772438511505D-01
 0.1163028265561117D-02   0.2544089433856365D 03   0.1685953722502038D-02
 0.3680679749070391D-01   0.4909703431394837D 03   0.9793246C12082950-01
-0.1535482236276087D-02   0.1130631303510265D 05  -0.5348938843501514D 01
-0.9742135503870485D-02   0.0                      0.0
 0.3130000000000291D 02   0.3970495590153000D 04   0.1541972177d63989D-01
 0.4773364359622972D-03   0.2544866170958540 03    0.1685982301032570D-02
 0.3662438835269296D-01   0.4909923451609568D 03   0.9606614626163970D-01
-0.2120201831511403D-02   0.1130577798404778D 05  -0.5353075311938227D 01
-0.6931876576095420D-01   0.0                      0.0
 0.3140000000000873D 02   0.3970492354860000D 04   0.1512899299381954D-01
-0.1948425930484399D-03   0.2544282143471081D 03   0.1686016915946577D-02
 0.3638159058626094D-01   0.4910147291686358D 03   0.9547039669923050D-01
-0.2739866025114182D-02   0.1130524225877035D 05  -0.5362049021537153D 01
-0.1064438877695011D 00   0.0                      0.0
 0.3150000000000600D 02   0.3970489119570000D 04   0.1476167288300085D-01
-0.8846800068866327D-03   0.2544377681874632D 03   0.1686039587070224D-02
 0.3607595065750367D-01   0.4910377481950694D 03   0.9608150086523110D-01
-0.3373434439045724D-02   0.1130470548812063D 05  -0.5373606550429902D 01
-0.1210014544833484D 00   0.0                      0.0
 0.3160000000000582D 02   0.3970485884280000D 04   0.1432616991193629D-01
-0.1446579663532479D-02   0.2544474394366752D 03   0.1686068322187551D-02
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-0.1131482894783744D 00   0.0                      0.0
 0.3169999999999709D 02   0.3970482648990000D 04   0.1383282763914071D-01
-0.1998502025403890D-02   0.2544573378573077D 03   0.1686097117128005D-02
 0.3527718905006238D-01   0.4910863697209998D 03   0.1006059436032068D 00
-0.4593909483740165D-02   0.1130362845176916D 05  -0.5395499651114786D 01
-0.8336439652930490D-01   0.0                      0.0
 0.3180000000000291D 02   0.3970479813700000D 04   0.1329441344355139D-01
-0.2482136360259132D-02   0.2544676051476610D 03   0.1686125956018061D-02
 0.3479013450305736D-01   0.4911111396139896D 03   0.1043158470942166D 00
-0.5136712748849969D-02   0.1130308856139978D 05  -0.5401458284093167D 01
-0.3241560382565466D-01   0.0                      0.0
 0.3190000000000873D 02   0.3970476178410000D 04   0.1272533238495986D-01
-0.2884317637584522D-02   0.2544782851314156D C3   0.1686154811690171D-02
 0.3425227530872402D-01   0.4911359121940947D 03   0.1088190794119749D 00
-0.5606714398324719D-02   0.1130254836392760D 05  -0.5401306565437096D 01
 0.3863649767026800D-01   0.0                      0.0
 0.3200000000000000D 02   0.3970472943120000D 04   0.1214166624569854D-01
-0.3191481856695064D-02   0.2544894055114374D 03   0.1686183646254031D-02
 0.3367184179383340D-01   0.4911619940123647D 03   0.1139567815925571D 00
-0.5985294591254630D-02   0.1130200856868264D 05  -0.5393102078458583D 01
 0.1283829723124654D 00   0.0                      0.0
 0.3210000000000582D 02   0.3970469770830000D 04   0.1156078018845720D-01
-0.3392150593842684D-02   0.2545010637188582D 03   0.1686212411843831D-02
 0.3305880053773303D-01   0.4911886291484021D 03   0.1195459638257420D 00
-0.6256452446394389D-02   0.1130147007169984D 05  -0.5375058129412025D 01
 0.2351156308984628D 00   0.0                      0.0
 0.3219999999999709D 02   0.3970466472540000D 04   0.1100092200800448D-01
-0.3476432507746578D-02   0.2545132939968245D 03   0.1686241051529593D-02
 0.3242456269203462D-01   0.4912157591364168D 03   0.1253814841339102D 00
```

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-0.6807385928830944D-02   0.1130093393864695D 05  -0.5345573629429566D 01
 0.3568345035160973D 00   0.0                      0.0
 0.3230000000000291D 02   0.3970463237250000D 04   0.1048076157989773D-01
-0.3436726571497794D-02   0.2545261109987791D 03   0.1686269500389065D-02
 0.3178163937627461D-01   0.4912423538966180D 03   0.1312397577056061D 00
-0.6828967354921821D-02   0.1130040138474857D 05  -0.5303263992877817D 01
 0.4912110556743414D 00   0.0                      0.0
 0.3240000000000873D 02   0.3970460001960000D 04   0.1001888074249872D-01
-0.3268209094883137D-02   0.2545395483899340D 03   0.1686297686746438D-02
 0.3111832554145752GD-01  0.4912704139782438D 03   0.1368803164897560 00
-0.6316098991548724D-02   0.1129987375158943D 05  -0.5246991188929997D 01
 0.6356421653072175D 00   0.0                      0.0
 0.3250000000000000D 02   0.3970456766670000D 04   0.9633226376486205D-02
-0.2969284371096101D-02   0.2545535301916754D 03   0.1686325533562456D-02
 0.3052293393361683D-01   0.4912984359445295D 03   0.1420709337535360D 00
-0.6067939114781317D-02   0.1129935248108590D 05  -0.5175891018455104D 01
 0.7372602455992066D 00   0.0                      0.0
 0.3260000000000582D 02   0.3970453531380000D 04   0.9340541781503835D-02
-0.2541977214784325D-02   0.2545679546066401D 03   0.1686352959969379D-02
 0.2993406501997266D-01   0.4913263135550952D 03   0.1465578619092076D 00
-0.5687998296086238D-02   0.1129883908674892D 05  -0.5089400280726011D 01
 0.9429307241120917D 00   0.0                      0.0
 0.3269999999999709D 02   0.3970450296090000D 04   0.9155793473203365D-02
-0.1992244937497855D-02   0.2545827827701494D 03   0.1686379882949445D-02
 0.2938947176105895D-01   0.4913544909803883D 03   0.1501108114580745D 00
-0.5188075290938672D-02   0.1129833512226354D 05  -0.4987283305232381D 01
 0.1099240517332040D 01   0.0                      0.0
 0.3280000000000291D 02   0.3970447060800000D 04   0.9091612131432590D-02
-0.1330186574259819D-02   0.2545979094192030D C3   0.1686406219127290D-02
 0.2890098665197853D-01   0.4913851755077768D 03   0.1525122544657942D 00
-0.4568193594213898D-02   0.1129784214793841D 05  -0.4869641998379279D 01
 0.1252858828058777D 01   0.0                      0.0
```

```
M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78
11000110111111110
0.33      1.0       2.0       3.0          1    2    3    4
0.0       220000.0  0.03      0.2       0.0
M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78
11030111111111110
0.33      1.0       2.0       3.0          1    2    3    4
0.0       220000.0  0.03      0.2       0.0
M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78
11000100111111110
0.33      1.0       2.0       3.0          1    2    3    4
0.0       220000.0  0.03      0.2       0.0
M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78
11000101111111110
0.33      1.0       2.0       3.0          1    2    3    4
0.0       220000.0  0.03      0.2       0.0
END
```

ORIGINAL PAGE IS
OF POOR QUALITY

Sample Output — MDLCK

```
   ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
    M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78

INPUT PARAMETERS:

 IDS=   1 LOC(1)=  1 LOC(7)=  0 LOC(13)= 1  EX1=  0.330000  PLOW=        0.0
 K =  329 LOC(2)=  1 LOC(8)=  0 LOC(14)= 0  EX2=  1.000000  PHIGH=  220000.00
 IEX1=  1 LOC(3)=  0 LOC(9)=  1 LOC(15)= 0  EX3=  2.000000  CDLOW= 0.03000000
 IEX2=  2 LOC(4)=  0 LOC(10)= 1 S= 155.000  EX4=  3.000000  CDHIGH=  0.200000
 IEX3=  3 LOC(5)=  0 LOC(11)= 1 G=32.20000  METRIC=  0
 IEX4=  4 LOC(6)=  0 LOC(12)= 1 TIA=0.0     RHO= 2.378000000D-03
```

MODEL SOLUTION

```
*
*  CASE 1     P0 = -1.907542729584629CD 04    CD0 =  9.7858791559805700D-02
*             P1 =  1.878328356449188OD 04    CD1 = -3.112781463376594OD 00
* POINT       P2 =  0.0                       CD2 =  7.521925407652667OD 01
* FAILURES    P3 =  0.0                       CD3 = -7.177614141186449OD 02
* =   0       P4 =  0.0                       CD4 =  2.531519230509964OD 03
*             P5 =  0.0                       CD5 =  0.0
*             P6 =  0.0                       CD6 =  0.0
*             P7 =  0.0
*
* FIT ERROR=  1.267838216347690OD-03
*
```

```
   ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
    M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78

INPUT PARAMETERS:

 IDS=   1 LOC(1)=  1 LOC(7)=  0 LOC(13)= 1  EX1=  0.330000  PLOW=        0.0
 K =  329 LOC(2)=  0 LOC(8)=  0 LOC(14)= 0  EX2=  1.000000  PHIGH=  220000.00
 IEX1=  1 LOC(3)=  1 LOC(9)=  1 LOC(15)= 0  EX3=  2.000000  CDLOW= 0.03000000
 IEX2=  2 LOC(4)=  1 LOC(10)= 0 S= 155.000  EX4=  3.000000  CDHIGH=  0.200000
 IEX3=  3 LOC(5)=  0 LOC(11)= 1 G=32.20000  METRIC=  0
 IEX4=  4 LOC(6)=  1 LOC(12)= 0 TIA=0.0     RHO= 2.378000000D-03
```

MODEL SOLUTION

```
*
*  CASE 2     P0 =  1.257208967384712OD 05    CD0 =  1.139761152979279OD-01
*             P1 =  0.0                       CD1 =  0.0
* POINT       P2 = -8.830547116378817CD 02    CD2 =  2.289219747219856OD 00
* FAILURES    P3 =  5.117791796370635OD 00    CD3 =  0.0
* = 139       P4 =  0.0                       CD4 =  4.946366047227504OD-01
*             P5 =  0.0                       CD5 =  0.0
*             P6 =  0.0                       CD6 =  0.0
*             P7 =  0.0
*
* FIT ERROR= NOGO
*
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
   ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
    M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78

INPUT PARAMETERS:

 IDS=    1 LOC(1)=   1 LOC(7)=   1 LOC(13)= 1   EX1=  0.330000  PLOW=        0.0
 K =   329 LOC(2)=   1 LOC(8)=   1 LOC(14)= 1   EX2=  1.000000  PHIGH=  220000.00
 IEX1=   1 LOC(3)=   0 LOC(9)=   1 LOC(15)= 1   EX3=  2.000000  CDLOW= 0.03000000
 IEX2=   2 LOC(4)=   0 LOC(10)= 1 S= 155.000    EX4=  3.000000  CDHIGH=  0.200000
 IEX3=   3 LOC(5)=   0 LOC(11)= 1 G=32.20000    METRIC=  0
 IEX4=   4 LOC(6)=   0 LOC(12)= 1 TIA=0.0       RHO= 2.378000000D-03
```

M O D E L S O L U T I O N

```
 CASE 3     P0 = -1.67279932366931000 05    CD0 =  1.0578236177750270D-01
            P1 =  4.6225563944157660D 04    CD1 = -2.9522029821300210D 00
 POINT      P2 =  0.0                       CD2 =  7.1582277591681330D 01
 FAILURES   P3 =  0.0                       CD3 = -6.7968774725152030D 02
 =    0     P4 =  0.0                       CD4 =  2.3604573381351100D 03
            P5 =  1.0251808370680070D 02    CD5 = -3.7985910360145450D-02
            P6 =  3.8167648764190490D 04    CD6 = -3.0345692924638160D-02
            P7 = -7.5874764891120240D 04

 FIT ERROR=  4.0330476066782180D-04
```

```
   ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD 40 / TAPE 33
    M2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78

INPUT PARAMETERS:

 IDS=    1 LOC(1)=   1 LOC(7)=   0 LOC(13)= 1   EX1=  0.330000  PLOW=        0.0
 K =   329 LOC(2)=   1 LOC(8)=   0 LOC(14)= 1   EX2=  1.000000  PHIGH=  220000.00
 IEX1=   1 LOC(3)=   0 LOC(9)=   1 LOC(15)= 1   EX3=  2.000000  CDLOW= 0.03000000
 IEX2=   2 LOC(4)=   0 LOC(10)= 1 S= 155.000    EX4=  3.000000  CDHIGH=  0.200000
 IEX3=   3 LOC(5)=   0 LOC(11)= 1 G=32.20000    METRIC=  0
 IEX4=   4 LOC(6)=   0 LOC(12)= 1 TIA=0.0       RHO= 2.378000000D-03
```

M O D E L S O L U T I O N

```
 CASE 4     P0 = -2.7421737821759680D 04    CD0 =  1.0170408476488630D-01
            P1 =  2.0739896227345200D 04    CD1 = -3.3236150323255800D 00
 POINT      P2 =  0.0                       CD2 =  8.1810452665467010D 01
 FAILURES   P3 =  0.0                       CD3 = -7.8777244545713970D 02
 =    0     P4 =  0.0                       CD4 =  2.7685680185972000D 03
            P5 =  1.5325397679C23000D 02    CD5 = -2.9569[illegible]9621422700D-02
            P6 =  0.0                       CD6 = -1.3805895088386370D-02
            P7 =  0.0

 FIT ERROR=  4.8129020022670690D-04
```

```
   ATLIT 2ND MANEUVER-FLAPS UP- PULL UP/PUSH OVER -FLIGHT RECORD #0 / TAPE 33
    #2 CALP1=0.8667,CALP2=0.01,DRIFT=-0.0247,INPUT THETA,ATLIT PU/PO 11/16/78

INPUT PARAMETERS:

 IDS=   1 LOC(1)=   1 LOC(7)=   0 LOC(13)= 1  EX1=  0.330000  PLOW=        0.0
 K =  329 LOC(2)=   1 LOC(8)=   1 LOC(14)= 1  EX2=  1.000000  PHIGH=  220000.00
 IEX1=  1 LOC(3)=   0 LOC(9)=   1 LOC(15)= 1  EX3=  2.000000  CDLOW= 0.03000000
 IEX2=  2 LOC(4)=   0 LOC(10)=  1 S= 155.000  EX4=  3.000000  CDHIGH=  0.200000
 IEX3=  3 LOC(5)=   0 LOC(11)=  1 G=32.20000  METRIC=  0
 IEX4=  4 LOC(6)=   0 LOC(12)=  1 TIA=0.0     RHO= 2.37800000D-03
```

MODEL SOLUTION

```
*                                                                              *
*  CASE 5     P0 = -1.37669764062112500 05   CD0 =  1.04599722754083700-01  *
*             P1 =  4.07061738949690200 04   CD1 = -3.02415265452013700 00  *
*  POINT      P2 =  0.0                      CD2 =  7.33858006062444000 01  *
*  FAILURES   P3 =  0.0                      CD3 = -6.97416476007442100 02  *
*  =    0     P4 =  0.0                      CD4 =  2.42350660745190100 03  *
*             P5 =  1.15854379656261600 02   CD5 = -5.94311807338621100-02  *
*             P6 =  0.0                      CD6 = -2.37534203172331200-02  *
*             P7 = -6.20075170244509100 04                                  *
*                                                                           *
*  FIT ERROR=  4.05741380348740300-04                                       *
*                                                                           *
```

APPENDIX C

FLIGHT DATA REDUCTION PROGRAM # 2

User Instructions – FDR2

The program is written in FORTRAN IV and is designed to execute in double-precision on an IBM 370/165 computer with an average execution time of 60 minutes for each maneuver data set. Execution requires approximately 936,000 bytes of core storage. Given the output of the FDR1 program (Appendix A), this program

(a) prints the input data in English or SI units,
(b) solves as many as 18 different model sets of power and drag coefficients,
(c) updates all rates for compatibility,
(d) calculates (1) a bias for the angle of attack values,
(2) a 1/3-power model and iterates for initial convergence of the coefficients in the lift expression,
(3) the coefficient values in the lift expression,
(4) new values of angle of attack from the expression of the lift function, and
(5) the frequency-dependent corrections to the angle-of-attack values,
(e) integrates the aircraft's equations of motion in the x-z plane to obtain time histories of both aircraft and flight path parameters, assuming airspeed and altitude are correct,
(f) estimates a specific fuel consumption,
(g) modifies the angle-of-attack values to obtain a better match with the aircraft's trajectory,
(h) predicts the flight path trajectory in an iterative procedure to attempt an improvement in the power, lift, and drag coefficients,
(i) computes the confidence levels for the angle-of-attack values and the pitch-angle values,
(j) prints the output results in English or SI units, and
(k) punches cards for stability analysis.

The program requires the specification of the following input:

CARD 1:

The title array TITLE.

The 80 characters of the array TITLE are used as control variables to end execution. Execution termination is achieved by following the last data card with a title card having only the word END in the first three card columns. It should be observed that on all other occasions this card behaves simply as a dummy card. Therefore, the user may wish to use this card to supply additional data set labeling.

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CARD 2:

(a) The read unit number IDS:
IDS is a right-adjusted integer number occupying columns 1-5 and specifying that the data is to be read from cards, magnetic tape, disk, etc. The user must supply the suitable job control cards for the tape and/or disk reads. The IDS parameter controls only the reading of CARDS 33, 34, and (35,...,34 + 5K). All other data is expected in card form.

(b) The input-data print code INPUT:
INPUT is a right-adjusted integer number occupying columns 6-10. If INPUT = 0, the input time histories are printed. If INPUT = 1, the input time histories are <u>not</u> printed.

(c) The plot code IPLOT:
IPLOT is a right-adjusted integer number occupying columns 11-15. If IPLOT = 0, plots will be allowed. If IPLOT = 1, no plots will be allowed.

(d) The punch code IPUNCH:
IPUNCH is a right-adjusted integer number occupying columns 16-20. If IPUNCH = 0, no cards will be punched. If IPUNCH = 1, cards will be punched.

(e) The desired type of input and output units METRIC:
If METRIC = 0, the input and output will be in English units.
If METRIC = 1, the input and output will be in SI units.
METRIC is a right-adjusted integer number occupying columns 21-25. The specification of METRIC only affects the listings. The punched output is in English units.

(f) The lift function code MTH:
MTH is a right-adjusted integer number, occupying columns 26-30, specifying the form of lift-coefficient equation. The following chart indicates the available forms:

MTH	FORM
0	$C_L = x_o + x_1\alpha$
1	$C_L = x_o + x_1\alpha + x_2\dot{\theta}$
2	$C_L = x_o + x_1\alpha + x_2\alpha^{x_3}$
3	$C_L = x_o + x_1\alpha + x_2\alpha^{x_3} + x_4\dot{\theta}$
4	$C_L = x_o + x_1\alpha^{x_2}$
5	$C_L = x_o + x_1\alpha^{x_2} + x_3\dot{\theta}$

If MTH > 5 or MTH < 0, the program sets MTH = 0.

(g) The method by which the coefficients in the lift expression are determined, MCLCC:

MCLCC is a right-adjusted integer number occupying columns 31-35. If MCLCC = 0, the lift coefficients (x_i's) are calculated by a linear-least-squares procedure. If MCLCC = 1, the lift coefficients (x_i's) are calculated by a least-square-distance procedure. If the user specifies MCLCC = 1 and the procedure is not capable of converging, the progarm defaults to MCLCC = 0.

(h) The maximum number MAXHPI of iterative attempts to improve the power, lift, and drag coefficients by trajectory predictions:

MAXHPI is a right-adjusted integer number, occupying columns 36-40, with a maximum permissible value of 5. MAXHPI does not control the preset number of sub-iterations between the power-drag model solutions.

CARD 3:

(a) The exponent EX1 on the second power-coefficient term,
(b) The exponent EX2 on the third power-coefficient term,
(c) The exponent EX3 on the fourth power-coefficient term,
(d) The exponent EX4 on the fifth power-coefficient term,
(e) The exponent IEX1 on the second drag-coefficient term,
(f) The exponent IEX2 on the third drag-coefficient term,
(g) The exponent IEX3 on the fourth drag-coefficient term, and
(h) The exponent IEX4 on the fifth drag-coefficient term:

EX1, EX2, EX3, and EX4 are floating-point numbers each occupying 10 columns beginning at column 1. It should be noted that no two of these exponents must have the same value; otherwise, execution will terminate. IEX1, IEX2, IEX3, IEX4 are right-adjusted integer numbers each occupying 5 columns beginning at column 41. It should be noted that no two of these exponents must have the same value; otherwise, execution will terminate.

CARD 4:

The power-drag model solution forms IMODEL(I),I=1,...,18:

IMODEL(I) are right-adjusted integer numbers, each occupying 1 column beginning at column 1, specifying the model(s) to be used for the determination of the power and drag coefficients. The general power and drag coefficient equations are

$$P = P_0 + P_1 V^{EX1} + P_2 V^{EX2} + P_3 V^{EX3} + P_4 V^{EX4} \quad \text{and}$$

$$C_D = C_{D_0} + C_{D_1} \alpha^{IEX1} + C_{D_2} \alpha^{IEX2} + C_{D_3} \alpha^{IEX3} + C_{D_4} \alpha^{IEX4}$$

Through the use of IMODEL(I), various combinations of the coefficients can be specified*. If IMODEL(I) = 0, the model will be bypassed. If IMODEL(I) = 1, the model solution will be performed. It is mandatory that at least one model is specified; otherwise, the program will terminate prematurely. The following chart should be used for the specification of the desired model(s):

IMODEL(I)	Coefficients Determined by Analysis
I = 1	P_0, C_{D_0}, C_{D_2}
I = 2	$P_0, P_1, C_{D_0}, C_{D_2}$
I = 3	$P_0, P_1, C_{D_0}, C_{D_2}, C_{D_4}$
I = 4	$P_0, P_1, C_{D_0}, C_{D_1}, C_{D_2}, C_{D_3}, C_{D_4}$
I = 5	$P_0, P_2, C_{D_0}, C_{D_2}$
I = 6	$P_0, P_2, C_{D_0}, C_{D_2}, C_{D_4}$
I = 7	$P_0, P_2, C_{D_0}, C_{D_1}, C_{D_2}, C_{D_3}, C_{D_4}$
I = 8	$P_0, P_1, P_2, C_{D_0}, C_{D_2}$
I = 9	$P_0, P_1, P_2, C_{D_0}, C_{D_2}, C_{D_4}$
I = 10	$P_0, P_1, P_2, C_{D_0}, C_{D_1}, C_{D_2}, C_{D_3}, C_{D_4}$
I = 11	$P_0, P_2, P_3, C_{D_0}, C_{D_2}$
I = 12	$P_0, P_2, P_3, C_{D_0}, C_{D_2}, C_{D_4}$
I = 13	$P_0, P_2, P_3, C_{D_0}, C_{D_1}, C_{D_2}, C_{D_3}, C_{D_4}$

*The user may wish to specify different models than those models provided. In order for this to be accomplished, the users must change the DATA statement and the INTEGER statement in Subroutine MODEL. The DATA statement assumes that 18 "different" models, each with a maximum of 10 coefficients for the power-drag model, will be specified. The INTEGER statement indicates the numbers of unknowns in the models of the DATA statement.

Chart (Continued)

IMODEL(I)	Coefficients Determined by Analysis
I = 14	$P_0, C_{D_0}, C_{D_1}, C_{D_2}$
I = 15	$P_0, P_1, C_{D_0}, C_{D_1}, C_{D_2}$
I = 16	$P_0, P_2, C_{D_0}, C_{D_1}, C_{D_2}$
I = 17	$P_0, P_1, P_2, C_{D_0}, C_{D_1}, C_{D_2}$
I = 18	$P_0, P_2, P_3, C_{D_0}, C_{D_1}, C_{D_2}$

CARD 5:

(a) The lower allowable limit PLOW of the power available in foot-pounds per second,
(b) The upper allowable limit PHIGH of the power available in foot-pounds per second,
(c) The lower allowable limit CDLOW of the drag coefficient,
(d) The upper allowable limit CDHIGH of the drag coefficient,
(e) The thrust incidence angle TIA in radians,
(f) The estimated initial flight-path-angle bias TARE in radians, and
(g) The estimated initial altitude bias HTARE in feet:
PLOW, PHIGH, CDLOW, CDHIGH, and TIA are floating-point numbers each occupying 10 columns beginning at column 1. TARE and HTARE are double-precision floating-point numbers each occupying 15 columns beginning at column 51.

CARDS 6,...,18:

(a) The a priori value AP(1) in $ft\text{-}lb_f/sec$ and its weight WGT(1) for the first power coefficient P_0,
(b) The a priori value AP(2) in suitable power units* and its weight WGT(2) for the second power coefficient P_1,
(c) The a priori value AP(3) in suitable power units* and its weight WGT(3) for the third power coefficient P_2,
(d) The a priori value AP(4) in suitable power units* and its weight WGT(4) for the fourth power coefficient P_3,
(e) The a priori value AP(5) in suitable power units* and its weight WGT(5) for the fifth power coefficient P_4,

*Since the "coefficients" of the power and drag coefficients' equations, given in the discussion of CARD 4, and the lift coefficients' equation, given in the discussion of CARD 2(f), are user-dependent, the user must specify the a priori values in suitable units.

(f) The a priori value AP(6) and its weight WGT(6) for the first drag coefficient C_{D_0},

(g) The a priori value AP(7) in suitable drag units* and its weight WGT(7) for the second drag coefficient C_{D_1},

(h) The a priori value AP(8) in suitable drag units* and its weight WGT(8) for the third drag coefficient C_{D_2},

(i) The a priori value AP(9) in suitable drag units* and its weight WGT(9) for the fourth drag coefficient C_{D_3},

(j) The a priori value AP(10) in suitable drag units* and its weight WGT(10) for the fifth drag coefficient C_{D_4},

(k) The a priori value AP(11) and its weight WGT(11) for the lift coefficient $C_{L_{\alpha_0}}$,

(l) The a priori value AP(12) in per radian and its weight WGT(12) for the lift coefficient C_{L_α}, and

(m) The a priori value AP(13) in suitable lift units* and its weight WGT(13) for the lift coefficient $C_{L_{\alpha_x}}$:

AP(I) and WGT(I) are double-precision floating-point numbers each occupying 20 columns beginning at column 1. Each of the thirteen (13) input cards contains the AP(I) and WGT(I) that correspond to the coefficient under consideration. A zero weight on any of the a priori values prevents the application of an a priori value to that coefficient.

CARD 19:

(a) The plot code IP(1) for weight,
(b) The plot code IP(2) for pitch angle,
(c) The plot code IP(3) for pitch rate,
(d) The plot code IP(4) for airspeed,
(e) The plot code IP(5) for density,
(f) The plot code IP(6) for angle of attack,
(g) The plot code IP(7) for static temperature,
(h) The plot code IP(8) for acceleration,
(i) The plot code IP(9) for angle-of-attack rate,
(j) The plot code IP(10) for altitude,
(k) The plot code IP(11) for altitude rate,
(l) The plot code IP(12) for altitude acceleration,
(m) The plot code IP(13) for vertical acceleration,

*(See previous note).

(n) The plot code IP(14) for elevator or stabilator deflection,
(o) The plot code IP(15) for lift coefficient versus angle of attack,
(p) The Plot code IP(16) for drag coefficient versus angle of attack,
(q) The plot code IP(17) for lift coefficient versus drag coefficient, and
(r) The plot code IP(18) for power available versus airspeed:
If IP(I) = 0, a plot is produced for the "I"th time history.
If IP(I) = 1, no plot is produced for the "I"th time history.
IP(I) are right-adjusted integer numbers each occupying one column beginning at column 1.

CARDS 20,...,32:

(a) The minimal allowable constraint CRMIN(1) and the maximal allowable constraint CRMAX(1) for the power coefficient P^*_0,
(b) The minimal allowable constraint CRMIN(2) and the maximal allowable constraint CRMAX(2) for the power coefficient P^*_1,
(c) The minimal allowable constraint CRMIN(3) and the maximal allowable constraint CRMAX(3) for the power coefficient P^*_2,
(d) The minimal allowable constraint CRMIN(4) and the maximal allowable constraint CRMAX(4) for the power coefficient P^*_3,
(e) The minimal allowable constraint CRMIN(5) and the maximal allowable constraint CRMAX(5) for the power coefficient P^*_4,
(f) The minimal allowable constraint CRMIN(6) and the maximal allowable constraint CRMAX(6) for the drag coefficient $C^*_{D_0}$,
(g) The minimal allowable constraint CRMIN(7) and the maximal allowable constraint CRMAX(7) for the drag coefficient $C^*_{D_1}$,
(h) The minimal allowable constraint CRMIN(8) and the maximal allowable constraint CRMAX(8) for the drag coefficient $C^*_{D_2}$,
(i) The minimal allowable constraint CRMIN(9) and the maximal allowable constraint CRMAX(9) for the drag coefficient $C^*_{D_3}$,
(j) The minimal allowable constraint CRMIN(10) and the maximal allowable constraint CRMAX(10) for the drag coefficient $C^*_{D_4}$,
(k) The minimal allowable constraint CRMIN(11) and the maximal allowable constraint CRMAX(11) for the lift coefficient $C^*_{L_{\alpha_0}}$,
(l) The minimal allowable constraint CRMIN(12) and the maximal allowable constraint CRMAX(12) for the lift coefficient $C^*_{L_\alpha}$, and
(m) The minimal allowable constraint CRMIN(13) and the maximal allowable constraint CRMAX(13) for the lift coefficient $C^*_{L_{\alpha_x}}$:

---

* Since the "coefficients" of the power, drag and lift coefficients' equations are user-dependent, the user must specify the values of CRMIN(I) and CRMAX(I) in suitable units.

CRMIN(I) and CRMAX(I) are double-precision floating-point numbers each occupying 20 columns beginning at column 1. Each of the thirteen (13) input cards contains the CRMIN(I) and CRMAX(I) that correspond to the coefficient under consideration.

CARD 33:

The title array TITLE:
The 80 characters of the array TITLE are used for identifying output. TITLE is provided by the first card of the punched output of the FDR1 program.

CARD 34:

(a) The total number of points K in the data set,
(b) The aircraft's wing area S in square feet,
(c) The sea-level atmospheric density RHO in slug/ft^3,
(d) The acceleration due to gravity G in ft/sec^2, and
(e) The total elapsed time for the maneuver TT in seconds:
K is a right-adjusted integer number occupying columns 1-10. S, RHO, G, and TT are double-precision floating-point numbers each occupying 15 columns beginning at column 11. These values are provided by the second card of the punched output of the FDR1 program.

CARD 35,...,(34 + 5K):

The time histories of time TIME(I), weight F1(I), pitch angle F2(I), pitch rate F3(I), airspeed F4(I), density F5(I), angle of attack F6(I), static temperature F7(I), acceleration F8(I), angle-of-attack rate F9(I), altitude F10(I), altitude rate F11(I), altitude acceleration F12(I), vertical acceleration F13(I), and elevator or stabilator deflection F14(I):
The variables TIME(I) and F1(I) through F14(I) are double-precision floating-point numbers each occupying 25 columns. These variables are provided by the remaining punched output of the FDR1 program.

For a given run consisting of more than one data set, cards 1 through (34 + 5K) must be specified for each data set.

Program Listing – FDR2

```
C   PROGRAM:  FLIGHT DATA REDUCTION #2 ( FDR2 )  P.O. SMETANA & S.R. FOX  ML   1
C                                                                         ML   2
C                                                                         ML   3
C        **************************************************               ML   4
C        *                                                *               ML   5
C        *   F L I G H T  D A T A  R E D U C T I O N  2   *               ML   6
C        *                                                *               ML   7
C        **************************************************               ML   8
C                                                                         ML   9
C                                                                         ML  10
C                                                                         ML  11
C     GIVEN VALUES OF THE AIRCRAFT CHARACTERISTICS AND THE AIRCRAFT'S     ML  12
C     FLIGHT TIME HISTORIES OF WEIGHT, PITCH ANGLE, PITCH RATE, AIRSPEED  ML  13
C     DENSITY, ANGLE OF ATTACK, STATIC TEMPERATURE, ACCELERATION, ANGLE-  ML  14
C     OF-ATTACK RATE, ALTITUDE, ALTITUDE RATE, ALTITUDE ACCELERATION,     ML  15
C     VERTICAL ACCELERATION, AND ELEVATOR (OR STABILATOR) DEFLECTION,     ML  16
C     THIS PROGRAM PERFORMS THE FOLLOWING:                                ML  17
C                                                                         ML  18
C        1) PRINTS INPUT DATA IN ENGLISH OR SI UNITS                      ML  19
C                                                                         ML  20
C        2) SOLVES UP THROUGH 18 DIFFERENT MODEL SOLUTIONS FOR POWER      ML  21
C           AND DRAG COEFFICIENTS                                         ML  22
C                                                                         ML  23
C        3) CALCULATES A BIAS FOR THE ANGLE-OF-ATTACK VALUES              ML  24
C                                                                         ML  25
C        4) UPDATES ALL RATES FOR COMPATIBILITY                           ML  26
C                                                                         ML  27
C        5) COMPUTES A 1/3-POWER MODEL ITERATION FOR INITIAL CONVERGENCE   ML  28
C                                                                         ML  29
C        6) COMPUTES THE LIFT COEFFICIENTS                                ML  30
C                                                                         ML  31
C        7) INSPECTS THE ANGLE-OF-ATTACK VALUES DUE TO THE LIFT COEF-     ML  32
C           FICIENTS                                                      ML  33
C                                                                         ML  34
C        8) CALCULATES FREQUENCY-DEPENDENT CORRECTIONS TO ANGLE-OF-       ML  35
C           ATTACK VALUES                                                 ML  36
C                                                                         ML  37
C        9) INTEGRATES THE AIRCRAFT'S EQUATIONS OF MOTION TO OBTAIN TIME  ML  38
C           HISTORIES OF BOTH AIRCRAFT AND FLIGHT PATH PARAMETERS ASSUM-  ML  39
C           ING AIRSPEED AND ALTITUDE ARE CORRECT                         ML  40
C                                                                         ML  41
C       10) CALCULATES A SPECIFIC FUEL CONSUMPTION                        ML  42
C                                                                         ML  43
C       11) MODIFIES ANGLE-OF-ATTACK VALUES DUE TO THE INTEGRATION OF     ML  44
C           AIRCRAFT'S EQUATION OF MOTION                                 ML  45
C                                                                         ML  46
C                                                                         ML  47
C       13) PREDICTS THE FLIGHT PATH TRAJECTORY IN AN ITERATIVE PROCE-    ML  48
C           DURE TO ATTEMPT AN IMPROVEMENT IN THE POWER, LIFT, AND DRAG   ML  49
C           COEFFICIENTS                                                  ML  50
C                                                                         ML  51
C       14) COMPUTES CONFIDENCE LEVELS FOR ANGLE-OF-ATTACK VALUES AND     ML  52
C           PITCH-ANGLE VALUES                                            ML  53
C                                                                         ML  54
C       15) PRINTS OUTPUT RESULTS IN ENGLISH OR SI UNITS                  ML  55
C                                                                         ML  56
C       16) PUNCHES CARDS FOR STABILITY ANALYSIS                          ML  57
C                                                                         ML  58
C                                                                         ML  59
C                                                                         ML  60
C     THE FOLLOWING COMMENT CARDS DESCRIBE THE NECESSARY INPUT FOR THIS   ML  61
C     PROGRAM.  FOR A MORE PRECISE DESCRIPTION, CONSULT THE USERS IN-     ML  62
C     STRUCTIONS.                                                         ML  63
C                                                                         ML  64
C                                                                         ML  65
C INPUT *** CARD 1                                                        ML  66
C                                                                         ML  67
C         TITLE  -> FIRST TITLE CARD (DUMMY CARD, EXCEPT FOR PROGRAM      ML  68
C                   TERMINATION)                                          ML  69
C                                                                         ML  70
C                                                                         ML  71
C                                                                         ML  72
C INPUT *** CARD 2                                                        ML  73
C                                                                         ML  74
C         IDS    -> READ UNIT NUMBER (ALLOWS READING OF CARDS, DISK,      ML  75
C                   TAPE, ETC OF PUNCHED CARDS FROM 'FDR1')               ML  76
C                                                                         ML  77
C         INPUT  -> CODE FOR INPUT DATA PRINT                             ML  78
C                   INPUT=0  -> PRINT INPUT DATA                          ML  79
C                   INPUT=1  -> NO PRINT                                  ML  80
C                                                                         ML  81
C         IPLOT  -> PLOT CODE                                             ML  82
C                   IPLOT=0  -> PLOT                                      ML  83
C                   IPLOT=1  -> NO PLOT                                   ML  84
C                                                                         ML  85
C         IPUNCH -> PUNCH CODE                                            ML  86
C                   IPUNCH=0 -> NO PUNCH                                  ML  87
C                   IPUNCH=1 -> PUNCH CARDS                               ML  88
C                                                                         ML  89
C         METRIC -> INPUT/OUTPUT PRINT CODE                               ML  90
C                   METRIC=0 -> INPUT & OUTPUT PRINTED IN ENGLISH UNITS   ML  91
C                   METRIC=1 -> INPUT & OUTPUT PRINTED IN SI UNITS        ML  92
C                                                                         ML  93
C         MTH    -> LIFT FUNCTION FORM CODE                               ML  94
C                   MTH=0 -> CL=X0+X1*A                                   ML  95
C                   MTH=1 -> CL=X0+X1*A+X2*B                              ML  96
C                   MTH=2 -> CL=X0+X1*A+X2*A**X3                          ML  97
C                   MTH=3 -> CL=X0+X1*A+X2*A**X3+X4*B                     ML  98
C                   MTH=4 -> CL=X0+X1*A**X3                               ML  99
C                   MTH=5 -> CL=X0+X1*A**X3+X4*B                          ML 100
C                            WHERE: A=ANGLE OF ATTACK                     ML 101
C                                   B=PITCH RATE                          ML 102
C                                                                         ML 103
C         MCLCC  -> METHOD OF LIFT COEFFICIENT CALCULATION                ML 104
C                   MCLCC=0 -> LINEAR LEAST SQUARES                       ML 105
C                   MCLCC=1 -> LEAST SQUARE DISTANCE                      ML 106
C                                                                         ML 107
C         MAXHPI -> MAXIMUM NUMBER OF ITERATIVE ATTEMPTS TO IMPROVE THE   ML 108
C                   POWER, LIFT, AND DRAG COEFFICIENTS BY TRAJECTORY      ML 109
C                   PREDICTIONS  (-1<MAXHPI<6)                            ML 110
C                                                                         ML 111
C                                                                         ML 112
C                                                                         ML 113
C INPUT *** CARD 3  (CONSULT USERS INSTRUCTIONS)                          ML 114
C                                                                         ML 115
C         EX1    -> EXPONENT ON SECOND POWER-COEFFICIENT TERM            ML 116
C                                                                         ML 117
```

```
C          EX2    -> EXPONENT ON THIRD POWER-COEFFICIENT TERM                  ML  118
C          EX3    -> EXPONENT ON FOURTH POWER-COEFFICIENT TERM                 ML  119
C          EX4    -> EXPONENT ON FIFTH POWER-COEFFICIENT TERM                  ML  120
C                                                                              ML  121
C          IEX1   -> EXPONENT ON SECOND DRAG-COEFFICIENT TERM (INTEGER)        ML  122
C          IEX2   -> EXPONENT ON THIRD DRAG-COEFFICIENT TERM  (INTEGER)        ML  123
C          IEX3   -> EXPONENT ON FOURTH DRAG-COEFFICIENT TERM (INTEGER)        ML  124
C          IEX4   -> EXPONENT ON FIFTH DRAG-COEFFICIENT TERM  (INTEGER)        ML  125
C                                                                              ML  126
C                                                                              ML  127
C INPUT *** CARD 4  (CONSULT USERS INSTRUCTIONS)                               ML  128
C                                                                              ML  129
C          IMODEL -> MODEL SOLUTION FORM (CHOSEN BY CARD COLUMN NUMBER)        ML  130
C                    IMODEL=0  -> SKIP MODEL                                   ML  131
C                    IMODEL=1  -> SOLVE MODEL                                  ML  132
C                                                                              ML  133
C                                                                              ML  134
C INPUT *** CARD 5                                                             ML  135
C                                                                              ML  136
C          PLOW   -> LOWER LIMIT OF ALLOWABLE POWER AVAILABLE (FT-LB/SEC)      ML  137
C                                                                              ML  138
C          PHIGH  -> UPPER LIMIT OF ALLOWABLE POWER AVAILABLE (FT-LB/SEC)      ML  139
C                                                                              ML  140
C          CDLOW  -> LOWER LIMIT OF ALLOWABLE DRAG COEFFICIENT                 ML  141
C                                                                              ML  142
C          CDHIGH -> UPPER LIMIT OF ALLOWABLE DRAG COEFFICIENT                 ML  143
C                                                                              ML  144
C          TIA    -> THRUST INCIDENCE ANGLE IN RADIANS                        ML  145
C                                                                              ML  146
C          TANE   -> ESTIMATED INITIAL FLIGHT-PATH-ANGLE BIAS IN RADIANS       ML  147
C                                                                              ML  148
C          HTANE  -> ESTIMATED INITIAL ALTITUDE BIAS IN FEET                   ML  149
C                                                                              ML  150
C                                                                              ML  151
C INPUT *** CARDS 6, ... ,18                                                   ML  152
C                                                                              ML  153
C          AP(1), WGT(1)    -> A PRIORI VALUE AND WEIGHT FOR P0                ML  154
C          AP(2), WGT(2)    -> A PRIORI VALUE AND WEIGHT FOR P1                ML  155
C          AP(3), WGT(3)    -> A PRIORI VALUE AND WEIGHT FOR P2                ML  156
C          AP(4), WGT(4)    -> A PRIORI VALUE AND WEIGHT FOR P3                ML  157
C          AP(5), WGT(5)    -> A PRIORI VALUE AND WEIGHT FOR P4                ML  158
C          AP(6), WGT(6)    -> A PRIORI VALUE AND WEIGHT FOR CD0               ML  159
C          AP(7), WGT(7)    -> A PRIORI VALUE AND WEIGHT FOR CD1               ML  160
C          AP(8), WGT(8)    -> A PRIORI VALUE AND WEIGHT FOR CD2               ML  161
C          AP(9), WGT(9)    -> A PRIORI VALUE AND WEIGHT FOR CD3               ML  162
C          AP(10), WGT(10)  -> A PRIORI VALUE AND WEIGHT FOR CD4               ML  163
C          AP(11), WGT(11)  -> A PRIORI VALUE AND WEIGHT FOR CLAO              ML  164
C          AP(12), WGT(12)  -> A PRIORI VALUE AND WEIGHT FOR CLA               ML  165
C          AP(13), WGT(13)  -> A PRIORI VALUE AND WEIGHT FOR CLAX              ML  166
C                                                                              ML  167
C                                                                              ML  168
C                                                                              ML  169
C                                                                              ML  170
C                                                                              ML  171
C                                                                              ML  172
C                                                                              ML  173
C                                                                              ML  174
C                                                                              ML  175
C                                                                              ML  176
C                                                                              ML  177
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C INPUT *** CARD 19                                                            ML  178
C                                                                              ML  179
C          IP(1)  -> PLOT CODE FOR WEIGHT TIME HISTORY                         ML  180
C                    IP(1)=0  -> REQUESTED                                     ML  181
C                    IP(1)=1  -> NOT REQUESTED                                 ML  182
C                                                                              ML  183
C          IP(2)  -> PLOT CODE FOR PITCH ANGLE TIME HISTORY                    ML  184
C                    IP(2)=0  -> REQUESTED                                     ML  185
C                    IP(2)=1  -> NOT REQUESTED                                 ML  186
C                                                                              ML  187
C          IP(3)  -> PLOT CODE FOR PITCH RATE TIME HISTORY                     ML  188
C                    IP(3)=0  -> REQUESTED                                     ML  189
C                    IP(3)=1  -> NOT REQUESTED                                 ML  190
C                                                                              ML  191
C          IP(4)  -> PLOT CODE FOR AIRSPEED TIME HISTORY                       ML  192
C                    IP(4)=0  -> REQUESTED                                     ML  193
C                    IP(4)=1  -> NOT REQUESTED                                 ML  194
C                                                                              ML  195
C          IP(5)  -> PLOT CODE FOR DENSITY TIME HISTORY                        ML  196
C                    IP(5)=0  -> REQUESTED                                     ML  197
C                    IP(5)=1  -> NOT REQUESTED                                 ML  198
C                                                                              ML  199
C          IP(6)  -> PLOT CODE FOR ANGLE OF ATTACK TIME HISTORY                ML  200
C                    IP(6)=0  -> REQUESTED                                     ML  201
C                    IP(6)=1  -> NOT REQUESTED                                 ML  202
C                                                                              ML  203
C          IP(7)  -> PLOT CODE FOR TEMPERATURE TIME HISTORY                    ML  204
C                    IP(7)=0  -> REQUESTED                                     ML  205
C                    IP(7)=1  -> NOT REQUESTED                                 ML  206
C                                                                              ML  207
C          IP(8)  -> PLOT CODE FOR ACCELERATION TIME HISTORY                   ML  208
C                    IP(8)=0  -> REQUESTED                                     ML  209
C                    IP(8)=1  -> NOT REQUESTED                                 ML  210
C                                                                              ML  211
C          IP(9)  -> PLOT CODE FOR ANGLE-OF-ATTACK RATE TIME HISTORY           ML  212
C                    IP(9)=0  -> REQUESTED                                     ML  213
C                    IP(9)=1  -> NOT REQUESTED                                 ML  214
C                                                                              ML  215
C          IP(10) -> PLOT CODE FOR ALTITUDE TIME HISTORY                       ML  216
C                    IP(10)=0 -> REQUESTED                                     ML  217
C                    IP(10)=1 -> NOT REQUESTED                                 ML  218
C                                                                              ML  219
C          IP(11) -> PLOT CODE FOR ALTITUDE RATE TIME HISTORY                  ML  220
C                    IP(11)=0 -> REQUESTED                                     ML  221
C                    IP(11)=1 -> NOT REQUESTED                                 ML  222
C                                                                              ML  223
C          IP(12) -> PLOT CODE FOR ALTITUDE ACCELERATION TIME HISTORY          ML  224
C                    IP(12)=0 -> REQUESTED                                     ML  225
C                    IP(12)=1 -> NOT REQUESTED                                 ML  226
C                                                                              ML  227
C          IP(13) -> PLOT CODE FOR VERTICAL ACCELERATION TIME HISTORY          ML  228
C                    IP(13)=0 -> REQUESTED                                     ML  229
C                    IP(13)=1 -> NOT REQUESTED                                 ML  230
C                                                                              ML  231
C          IP(14) -> PLOT CODE FOR ELEVATOR/STABILATOR TIME HISTORY            ML  232
C                    IP(14)=0 -> REQUESTED                                     ML  233
C                    IP(14)=1 -> NOT REQUESTED                                 ML  234
C                                                                              ML  235
C          IP(15) -> PLOT CODE FOR LIFT COEFFICIENT VS ANGLE OF ATTACK         ML  236
C                    IP(15)=0 -> REQUESTED                                     ML  237
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C                IP(15)=1 -> NOT REQUESTED                                  ML  238
C                                                                           ML  239
C          IP(16) -> PLOT CODE FOR DRAG COEFFICIENT VS ANGLE OF ATTACK      ML  240
C                    IP(16)=0 -> REQUESTED                                  ML  241
C                    IP(16)=1 -> NOT REQUESTED                              ML  242
C                                                                           ML  243
C          IP(17) -> PLOT CODE FOR LIFT COEFFICIENT VS DRAG COEFFICIENT     ML  244
C                    IP(17)=0 -> REQUESTED                                  ML  245
C                    IP(17)=1 -> NOT REQUESTED                              ML  246
C                                                                           ML  247
C          IP(18) -> PLOT CODE FOR POWER AVAILABLE VS AIRSPEED              ML  248
C                    IP(18)=0 -> REQUESTED                                  ML  249
C                    IP(18)=1 -> NOT REQUESTED                              ML  250
C                                                                           ML  251
C                                                                           ML  252
C                                                                           ML  253
C INPUT *** CARDS 20, ... ,32                                               ML  254
C                                                                           ML  255
C          CRMIN(1), CRMAX(1)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR PO     ML  256
C          CRMIN(2), CRMAX(2)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR P1     ML  257
C          CRMIN(3), CRMAX(3)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR P2     ML  258
C          CRMIN(4), CRMAX(4)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR P3     ML  259
C          CRMIN(5), CRMAX(5)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR P4     ML  260
C          CRMIN(6), CRMAX(6)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR CD0    ML  261
C          CRMIN(7), CRMAX(7)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR CD1    ML  262
C          CRMIN(8), CRMAX(8)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR CD2    ML  263
C          CRMIN(9), CRMAX(9)   -> MINIMUM & MAXIMUM CONSTRAINTS FOR CD3    ML  264
C          CRMIN(10), CRMAX(10)-> MINIMUM & MAXIMUM CONSTRAINTS FOR CD4     ML  265
C          CRMIN(11), CRMAX(11)-> MINIMUM & MAXIMUM CONSTRAINTS FOR CLA0    ML  266
C          CRMIN(12), CRMAX(12)-> MINIMUM & MAXIMUM CONSTRAINTS FOR CLA     ML  267
C          CRMIN(13), CRMAX(13)-> MINIMUM & MAXIMUM CONSTRAINTS FOR CLAX    ML  268
C                                                                           ML  269
C                                                                           ML  270
C                                                                           ML  271
C INPUT *** CARD 33                                                         ML  272
C                                                                           ML  273
C          TITLE  -> TITLE CARD FOR MANEUVER (PUNCHED CARD FROM 'FDR1')     ML  274
C                                                                           ML  275
C                                                                           ML  276
C                                                                           ML  277
C INPUT *** CARD 34 (PUNCHED CARD FROM 'FDR1')                              ML  278
C                                                                           ML  279
C          K      -> NUMBER OF POINTS IN DATA SET                           ML  280
C                                                                           ML  281
C          S      -> AIRCRAFT'S WING AREA IN SQUARE FEET                    ML  282
C                                                                           ML  283
C          RHO    -> SEA-LEVEL ATMOSPHERIC DENSITY IN SLUG/FT**3            ML  284
C                                                                           ML  285
C          G      -> ACCELERATION DUE TO GRAVITY IN FT/SEC**2               ML  286
C                                                                           ML  287
C          TT     -> TOTAL ELAPSED TIME FOR MANEUVER IN SECONDS             ML  288
C                                                                           ML  289
C                                                                           ML  290
C                                                                           ML  291
C INPUT *** CARDS 35, ... ,(34+5K)  (PUNCHED CARDS FROM 'FDR1')             ML  292
C                                                                           ML  293
C          IDENTIFICATION OF NECESSARY INPUT TIME HISTORIES                 ML  294
C                                                                           ML  295
C               TIME(I)  -> TIME                                            ML  296
C               F1(I)    -> WEIGHT                                          ML  297
C               F2(I)    -> PITCH ANGLE                                     ML  298
C               F3(I)    -> PITCH RATE                                      ML  299
C               F4(I)    -> AIRSPEED                                        ML  300
C               F5(I)    -> DENSITY                                         ML  301
C               F6(I)    -> ANGLE OF ATTACK                                 ML  302
C               F7(I)    -> STATIC TEMPERATURE                              ML  303
C               F8(I)    -> ACCELERATION                                    ML  304
C               F9(I)    -> ANGLE-OF-ATTACK RATE                            ML  305
C               F10(I)   -> ALTITUDE                                        ML  306
C               F11(I)   -> ALTITUDE RATE                                   ML  307
C               F12(I)   -> ALTITUDE ACCELERATION                           ML  308
C               F13(I)   -> VERTICAL ACCELERATION                           ML  309
C               F14(I)   -> ELEVATOR (OR STABILATOR) DEFLECTION             ML  310
C                                                                           ML  311
C                                                                           ML  312
C                                                                           ML  313
C                                                                           ML  314
      IMPLICIT REAL*8(A-H,O-Z)                                              ML  315
      EXTERNAL VA,DDV,DDDV,ALP,DVA,PHIDER                                   ML  316
      DIMENSION TITLE(20),IMODEL(18),FIT(2),ALPHA(450),THETA(450),DUM(45    ML  317
     10),AL(4),WRK(1367),IP(18),TRG(21),MHPI(5),IHPATH(5)                   ML  318
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F    ML  319
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450    ML  320
     1),C(450,11),X(450,5),WKAR(250),CFM(14),SGM(4),SGD(4),FT1(450),FT2(    ML  321
     1450),PHRA(450),CL(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S    ML  322
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX    ML  323
     12,IEX3,IEX4,METRIC,L1,L2,IEQNS(18),IERR                               ML  324
      COMMON /LAB2/ICEPT,ICD,MTH,MCLCC                                      ML  325
      COMMON /LAB8/ALPHA1,P1,PAC(8),Z1,Z2                                   ML  326
      COMMON /LAB9/ADF(450)                                                 ML  327
      COMMON /LAB1/AP(13),WGT(13),CRMIN(13),CRMAX(13)                       ML  328
      INTEGER NLLS(6)/2,3,3,4,2,3/,NLSD(6)/2,2,4,4,3,3/                     ML  329
      DATA TRG/0.0D0,5.0D0,10.0D0,15.0D0,20.0D0,25.0D0,30.0D0,35.0D0,40.    ML  330
     10D0,45.0D0,50.0D0,55.0D0,60.0D0,65.0D0,70.0D0,75.0D0,80.0D0,85.0D0    ML  331
     1,90.0D0,95.0D0,100.0D0/,IHPATH/6,5,5,5,8/,XEND/4HEND /                ML  332
C                                                                           ML  333
C                                                                           ML  334
C***  SPECIFY CARRIAGE CONTROL FOR INSTALLATION                             ML  335
      JREAD=1                                                               ML  336
      JWRITE=3                                                              ML  337
      JPUNCH=2                                                              ML  338
      JPLOT=0                                                               ML  339
C                                                                           ML  340
C                                                                           ML  341
    1 READ (JREAD,2) (TITLE(I),I=1,20)                                      ML  342
    2 FORMAT (20A4)                                                         ML  343
C                                                                           ML  344
C***  CHECK FOR PROGRAM TERMINATION                                         ML  345
      IF (TITLE(1).EQ.XEND) GO TO 200                                       ML  346
C***  INITIALIZE CODES                                                      ML  347
      LPRG=1                                                                ML  348
      ISPT=0                                                                ML  349
      LPSS=0                                                                ML  350
      IERR=0                                                                ML  351
      IUP=0                                                                 ML  352
      ISW=0                                                                 ML  353
      IEN=0                                                                 ML  354
      IPATH=0                                                               ML  355
      FITOK=1.0D-13                                                         ML  356
      LPRGMX=1                                                              ML  357
      ITERM=0
```

```
C
C
      READ (JREAD,3) IDS,INPUT,IPLOT,IPUNCH,METRIC,NTH,NCLCC,MAXHPI
    3 FORMAT (8I5)
C
C***  CHECK FOR ERROR IN IDS
      IF (IDS.LE.3) IDS=JREAD
C
C
      READ (JREAD,4) EX1,EX2,EX3,EX4,IEX1,IEX2,IEX3,IEX4
    4 FORMAT (4F10.0,4I5)
C
C
      READ (JREAD,5) (IMODEL(I),I=1,18)
    5 FORMAT (18I1)
C
C
      READ (JREAD,6) PLOW,PHIGH,CDLOW,CDHIGH,TIA,TARE,HTARE
    6 FORMAT (5F10.0,2D15.0)
C
C
      READ (JREAD,7) (AP(I),WGT(I),I=1,13)
    7 FORMAT (2D20.0)
C
C
      READ (JREAD,8) (IP(I),I=1,18)
    8 FORMAT (18I1)
C
C
      READ (JREAD,9) (CRMIN(I),CRMAX(I),I=1,13)
    9 FORMAT (2D20.0)
C
C
      READ (IDS,10) (TITLE(I),I=1,20)
   10 FORMAT (20A4)
C
C
      READ (IDS,11) K,S,RHO,G,TT
   11 FORMAT (I10,4D15.8)
C
      DO 14 I=1,K
C
C
      READ (IDS,12) TIME(I),F1(I),F2(I),F3(I),F4(I),F5(I),F6(I),F7(I),F8
     1(I),F9(I),F10(I),F11(I),F12(I),F13(I),F14(I)
   12 FORMAT (3D25.16)
C
C
C
C
C***  TEST FOR INCREASING TIME
      IF (I.EQ.1) GO TO 14
      IF (TIME(I).GT.TIME(I-1)) GO TO 14
      WRITE (JWRITE,13) I
   13 FORMAT (1X,//,10X,'PROGRAM FOUND TIME VALUE = OR < TIME OF PREVIOU
     1S POINT AT PT ',I3)
      GO TO 1
   14 CONTINUE
C***  THESE TWO COMMENT CARDS ARE SUPPLIED SOLELY FOR THE USER TO USE
C***  AT HIS CONVENIENCE
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C***  CHECK FOR NTH OR MAXHPI ERRORS
      IF (NTH.LT.0.OR.NTH.GT.5) NTH=0
      MAXHPI=IABS(MAXHPI)
      IF (MAXHPI.GT.5) MAXHPI=5
C***  DETERMINE MODEL NUMBERS
      IKM=0
      DO 15 IL=1,18
      IF (IMODEL(IL) EQ.0) GO TO 15
      IKM=IKM+1
      IEQNM(IKM)=IL
   15 CONTINUE
C***  CHECK FOR MODEL ERROR
      IF (IKM.EQ.0) WRITE (JWRITE,16)
   16 FORMAT (1X,//,10X,'ERROR DETECTED IN MODEL CODE.  TO NEXT DATA SET
     1, IF ANY.')
      IF (IKM.EQ.0) GO TO 1
      L1=1
      L2=IKM
C***  PRINT TITLE
      WRITE (JWRITE,17) (TITLE(I),I=1,20)
   17 FORMAT (1H1,////,23X,84('*'),/,23X,'*',82X,'*',/,23X,'*',20A4,2X,'
     1*',/,23X,'*',82X,'*',/,23X,84('*'))
C***  WRITE INPUT PARAMETERS
      WRITE (JWRITE,18) IDS,EX1,PLOW,TIA,INPUT,EX2,PHIGH,TARE,IPLOT,EX3,
     1CDLOW,HTARE,IPUNCH,EX4,CDHIGH,G,METRIC,K,S,RHO,TT,NTH,IEX1,IEX2,IE
     1X3,IEX4,(IMODEL(I),I=1,18),(IP(I),I=1,18)
   18 FORMAT (1X,//,18X,95('-'),//,19X,'INPUT PARAMETERS:',//,27X,'IDS
     1=',I2,2X,'EX1=',F10.7,2X,'PLOW=',D16.9,2X,'TIA=',D16.9,/,27X,'INPU
     1T=',I2,2X,'EX2=',F10.7,2X,'PHIGH=',D15.8,2X,'TARE=',D15.8,/,27X,'I
     1PLOT=',I2,2X,'EX3=',F10.7,2X,'CDLOW=',D15.8,2X,'HTARE=',D14.7,/,27
     1X,'IPUNCH=',I1,2X,'EX4=',F10.7,2X,'CDHIGH=',D14.7,2X,'G=',F10.7,/,
     127X,'METRIC=',I1,2X,'K=',I3,2X,'S=',F5.1,2X,'RHO=',D17.10,2X,'TT='
     1,F9.6,/,27X,'NTH  =',I2,2X,'IEX1=',I3,2X,'IEX2=',I3,2X,'IEX3=',I3,
     12X,'IEX4=',I3,2X,'IMODEL(1)=',I2,/,27X,'IMODEL(2)=',I2,2X,'IMODEL(
     13)=',I2,2X,'IMODEL(4)=',I2,2X,'IMODEL(5)=',I2,2X,'IMODEL(6)=',I2,/
     1,27X,'IMODEL(7)=',I2,2X,'IMODEL(8)=',I2,2X,'IMODEL(9)=',I2,2X,'IMO
     1DEL(10)=',I1,2X,'IMODEL(11)=',I1,/,27X,'IMODEL(12)=',I1,2X,'IMODEL
     1(13)=',I1,2X,'IMODEL(14)=',I1,2X,'IMODEL(15)=',I1,2X,'IMODEL(16)='
     1,I1,/,27X,'IMODEL(17)=',I1,2X,'IMODEL(18)=',I1,2X,'IP(1)=',I2,2X,'
     1IP(2)=',I2,2X,'IP(3)=',I2,2X,'IP(4)=',I2,/,27X,'IP(5)=',I2,2X,'IP(
     16)=',I2,2X,'IP(7)=',I2,2X,'IP(8)=',I2,2X,'IP(9)=',I2,2X,'IP(10)=',
     1I1,2X,'IP(11)=',I1,/,27X,'IP(12)=',I1,2X,'IP(13)=',I1,2X,'IP(14)='
     1,I1,2X,'IP(15)=',I1,2X,'IP(16)=',I1,2X,'IP(17)=',I1,2X,'IP(18)=',I
     11)
      WRITE (JWRITE,19) (I,AP(I),I,WGT(I),I,CRMIN(I),I,CRMAX(I),I=1,13)
   19 FORMAT (19X,'AP(',I2,')=',1PD14.7,2X,'WGT(',I2,')=',1PD11.4,2X,'CR
     1MIN(',I2,')=',1PD13.6,2X,'CRMAX(',I2,')=',1PD13.6)
      WRITE (JWRITE,20)
   20 FORMAT (1X,/,18X,95('-'))
      IF (METRIC.NE.0) GO TO 22
      WRITE (JWRITE,21) S,RHO,G,TT
   21 FORMAT (1X,//,38X,51('*'),/,38X,'*',49X,'*',/,38X,'*',13H WING ARE
     1A = ,F10.5,6H FT**2,20X,'*',/,38X,'*',21H REFERENCE DENSITY = ,F10
     1.8,11H SLUG/FT**3,7X,'*',/,38X,'*',31H ACCELERATION DUE TO GRAVITY
     1 = ,F7.4,10H FT/SEC**2,1X,'*',/,38X,'*',19H TOTAL TEST TIME = ,F10
     1.4,8H SECONDS,12X,'*',/,38X,'*',49X,'*',/,38X,51('*'))
      GO TO 24
   22 SKM=S*0.3048D0**2
      RHOM=RHO*515.38D0
      GKM=G*0.3048D0
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      WRITE (JWRITE,23) SNN,RHON,GNN,TT                                 ML  478
      WRITE (JWRITE,24)                                                 ML  479
   23 FORMAT (1X,//,38X,51('*'),/,38X,'*',49X,'*',/,38X,'*',13H WING ARE ML  480
     1A = ,F11.5,5H M**2,20X,'*',/,38X,'*',21H REFERENCE DENSITY = ,F12. ML  481
     1,8H KG/M**3,8X,'*',/,38X,'*',31H ACCELERATION DUE TO GRAVITY = ,F ML  482
     18.4,9H M/SEC**2,1X,'*',/,38X,'*',19H TOTAL TEST TIME = ,F10.4,8H S ML  483
     1ECONDS,12X,'*',/,38X,'*',49X,'*',/,38X,51('*'))                   ML  484
C***  CHECK FOR INITIAL INPUT AND MODIFIED INPUT PRINTOUT               ML  485
      IF (INPUT.NE.0) GO TO 47                                          ML  486
      IF (METRIC.NE.0) GO TO 28                                         ML  487
      IF (ISW.EQ.0) WRITE (JWRITE,26) LPRG                              ML  488
      IF (ISW.NE.0) WRITE (JWRITE,27) LPRG                              ML  489
   26 FORMAT (1X,//,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',12X,'INITIAL ML  490
     1 INPUT DATA (FOR PROGRAM LOOP#',I2,')',14X,'*',/,31X,'*',66X,'*',/ ML  491
     1,31X,68('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'| ML  492
     1',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8X,'| ML  493
     1',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE,5X, ML  494
     1'|',5X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',7X,5H ML  495
     1(LBF),7X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'|',5X,8H ML  496
     1(FT/SEC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X,'|',1 ML  497
     19X,'*',/,6X,'*',119('-'),'*')                                     ML  498
   27 FORMAT (1X,//,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',14X,'MODIFIE ML  499
     1D DATA (FOR PROGRAM LOOP#',I2,')',17X,'*',/,31X,'*',66X,'*',/,31X, ML  500
     168('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X ML  501
     1,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8X,'|',6X, ML  502
     16HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE,5X,'|',5 ML  503
     1X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',7X,5H(LBF) ML  504
     1,7X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'|',5X,8H(FT/S ML  505
     1EC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X,'|',19X,'* ML  506
     1',/,6X,'*',119('-'),'*')                                          ML  507
      GO TO 31                                                          ML  508
   28 IF (ISW.EQ.0) WRITE (JWRITE,29) LPRG                              ML  509
      IF (ISW.NE.0) WRITE (JWRITE,30) LPRG                              ML  510
   29 FORMAT (1X,//,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',12X,'INITIAL ML  511
     1 INPUT DATA (FOR PROGRAM LOOP#',I2,')',14X,'*',/,31X,'*',66X,'*',/ ML  512
     1,31X,68('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'| ML  513
     1',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8X,'| ML  514
     1',6X,6HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE,5X, ML  515
     1'|',5X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',5X,9H ML  516
     1(NEWTONS),5X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'|',6 ML  517
     1X,7H(M/SEC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X,'| ML  518
     1',19X,'*',/,6X,'*',119('-'),'*')                                  ML  519
   30 FORMAT (1X,//,31X,68('*'),/,31X,'*',66X,'*',/,31X,'*',14X,'MODIFIE ML  520
     1D DATA (FOR PROGRAM LOOP#',I2,')',17X,'*',/,31X,'*',66X,'*',/,31X, ML  521
     168('*'),/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X ML  522
     1,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4HTIME,8X,'|',6X, ML  523
     16HWEIGHT,7X,'|',3X,11HPITCH ANGLE,5X,'|',4X,10HPITCH RATE,5X,'|',5 ML  524
     1X,8HAIRSPEED,6X,'*',/,6X,'*',19X,'|',6X,6H(SECS),7X,'|',5X,9H(NEWT ML  525
     1ONS),5X,'|',4X,9H(RADIANS),6X,'|',3X,12H(RADIAN/SEC),4X,'|',6X,7H( ML  526
     1M/SEC),6X,'*',/,6X,'*',19X,'|',19X,'|',19X,'|',19X,'|',19X,'|',19X ML  527
     1,'*',/,6X,'*',119('-'),'*')                                       ML  528
      IF (METRIC.NE.0) GO TO 41                                         ML  529
C***  WRITE INPUT IN ENGLISH UNITS                                      ML  530
      DO 32 I=1,K                                                       ML  531
   32 WRITE (JWRITE,33) I,TIME(I),F1(I),F2(I),F3(I),F4(I)               ML  532
   33 FORMAT (6X,'*',7X,I3,9X,'|',6X,F7.3,6X,'|',4X,F10.4,5X,'|',3X,F11. ML  533
     17,5X,'|',4X,F10.7,5X,'|',5X,F8.4,6X,'*')                          ML  534
      WRITE (JWRITE,34)                                                 ML  535
   34 FORMAT (6X,'*',119X,'*',/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X ML  536
     1,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4 ML  537
     1HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',4X,1 ML  538
     11HTEMPERATURE,4X,'|',3X,12HACCELERATION,4X,'*',/,6X,'*',19X,'|',6X ML  539
     1,6H(SECS),7X,'|',3X,12H(SLUG/FT**3),4X,'|',4X,9H(RADIANS),6X,'|',6 ML  540
     1X,7H(DEG-R),6X,'|',4X,11H(FT/SEC**2),4X,'*',/,5X,'*',19X,'|',19X,' ML  541
     1|',19X,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',119('-'),'*')         ML  542
      DO 35 I=1,K                                                       ML  543
   35 WRITE (JWRITE,36) I,TIME(I),F5(I),F6(I),F7(I),F8(I)               ML  544
   36 FORMAT (6X,'*',7X,I3,9X,'|',6X,F7.3,6X,'|',4X,F10.8,5X,'|',4X,F11. ML  545
     17,4X,'|',7X,F6.2,6X,'|',4X,F9.5,6X,'*')                           ML  546
      WRITE (JWRITE,37)                                                 ML  547
   37 FORMAT (6X,'*',119X,'*',/,6X,121('*'))                            ML  548
      WRITE (JWRITE,38)                                                 ML  549
   38 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X ML  550
     1,'|',16X,'*',/,6X,'*',1X,10HDATA POINT,1X,'|',3X,4HTIME,3X,'|',1X, ML  551
     120HANGLE-OF-ATTACK RATE,1X,'|',1X,8HALTITUDE,1X,'|',1X,13HALTITUDE ML  552
     1 RATE,1X,'|',1X,11HALT. ACCEL.,1X,'|',1X,12HVERT. ACCEL.,1X,'|',1X ML  553
     1,14HELEV. DEFLECT.,1X,'*',/,6X,'*',12X,'|',2X,6H(SECS),2X,'|',5X,1 ML  554
     12H(RADIAN/SEC),5X,'|',3X,4H(FT),3X,'|',4X,8H(FT/SEC),3X,'|',1X,11H ML  555
     1(FT/SEC**2),1X,'|',2X,11H(FT/SEC**2),1X,'|',3X,9H(RADIANS),4X,'*', ML  556
     1/,6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X,'|',1 ML  557
     16X,'*',/,6X,'*',119('-'),'*')                                     ML  558
      WRITE (JWRITE,39) (I,TIME(I),F9(I),F10(I),F11(I),F12(I),F13(I),F14 ML  559
     1(I),I=1,K)                                                        ML  560
   39 FORMAT (6X,'*',4X,I4,4X,'|',2X,F6.3,2X,'|',5X,F12.9,5X,'|',1X,F8.2 ML  561
     1,1X,'|',4X,F7.2,4X,'|',2X,F8.2,3X,'|',4X,F6.2,4X,'|',4X,F8.5,4X,'* ML  562
     1')                                                                ML  563
      WRITE (JWRITE,40)                                                 ML  564
   40 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X ML  565
     1,'|',16X,'*',/,6X,121('*'))                                       ML  566
      IF (IPATH.NE.0) GO TO 174                                         ML  567
      IF (ISW.NE.0) GO TO 150                                           ML  568
      GO TO 47                                                          ML  569
C***  WRITE INPUT IN SI UNITS                                           ML  570
   41 DO 42 I=1,K                                                       ML  571
      WS=F1(I)*4.448200                                                 ML  572
      VS=F4(I)*0.3048D0                                                 ML  573
   42 WRITE (JWRITE,33) I,TIME(I),WS,F2(I),F3(I),VS                     ML  574
      WRITE (JWRITE,43)                                                 ML  575
   43 FORMAT (6X,'*',119X,'*',/,6X,121('*'),/,6X,'*',19X,'|',19X,'|',19X ML  576
     1,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',4X,10HDATA POINT,5X,'|',7X,4 ML  577
     1HTIME,8X,'|',5X,7HDENSITY,7X,'|',2X,15HANGLE OF ATTACK,2X,'|',4X,1 ML  578
     11HTEMPERATURE,4X,'|',3X,12HACCELERATION,4X,'*',/,6X,'*',19X,'|',6X ML  579
     1,6H(SECS),7X,'|',4X,9H(KG/M**3),6X,'|',4X,9H(RADIANS),6X,'|',6X,7H ML  580
     1(DEG-K),6X,'|',4X,10H(M/SEC**2),5X,'*',/,6X,'*',19X,'|',19X,'|',19 ML  581
     1X,'|',19X,'|',19X,'|',19X,'*',/,6X,'*',119('-'),'*')              ML  582
      DO 44 I=1,K                                                       ML  583
      DS=F5(I)*515.38D0                                                 ML  584
      AS=F8(I)*0.3048D0                                                 ML  585
      TK=5.0D0/9.0D0*(F7(I)-491.72D0)+273.18D0                          ML  586
   44 WRITE (JWRITE,36) I,TIME(I),DS,F6(I),TK,AS                        ML  587
      WRITE (JWRITE,37)                                                 ML  588
      WRITE (JWRITE,45)                                                 ML  589
   45 FORMAT (6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X ML  590
     1,'|',16X,'*',/,6X,'*',1X,10HDATA POINT,1X,'|',3X,4HTIME,3X,'|',1X, ML  591
     120HANGLE-OF-ATTACK RATE,1X,'|',1X,8HALTITUDE,1X,'|',1X,13HALTITUDE ML  592
     1 RATE,1X,'|',1X,11HALT. ACCEL.,1X,'|',1X,12HVERT. ACCEL.,1X,'|',1X ML  593
     1,14HELEV. DEFLECT.,1X,'*',/,6X,'*',12X,'|',2X,6H(SECS),2X,'|',5X,1 ML  594
     12H(RADIAN/SEC),5X,'|',1X,8H(METERS),1X,'|',4X,7H(M/SEC),4X,'|',2X, ML  595
     110H(M/SEC**2),1X,'|',2X,10H(M/SEC**2),2X,'|',3X,9H(RADIANS),4X,'*' ML  596
     1,/,6X,'*',12X,'|',10X,'|',22X,'|',10X,'|',15X,'|',13X,'|',14X,'|', ML  597
     116X,'*',/,6X,'*',119('-'),'*')
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      DO 46 I=1,K                                                       ML  598
      HS=F10(I)*0.3048D0                                                ML  599
      HDS=F11(I)*0.3048D0                                               ML  600
      HDDS=F12(I)*0.3048D0                                              ML  601
      AZS=F13(I)*0.3048D0                                               ML  602
   46 WRITE (JWRITE,39) I,TIME(I),F9(I),HS,HDS,HDDS,AZS,F14(I)          ML  603
      WRITE (JWRITE,40)                                                 ML  604
C***  CHECK FOR PROGRAM DIRECTION                                       ML  605
      IF (IPATH.NE.0) GO TO 174                                         ML  606
      IF (ISW.NE.0) GO TO 150                                           ML  607
C***  CALL MODEL EXTRACTION                                             ML  608
   47 CALL MODEL(K,LPRG,FIT,HNB)                                        ML  609
      IF (IERR.NE.0) GO TO 1                                            ML  610
C***  CHECK FIT ERROR                                                   ML  611
      IF (LPRG.EQ.1.AND.FIT(LPRG).EQ.1.0D+60) GO TO 1                   ML  612
      IJKL=1                                                            ML  613
      IF (LPRG.GT.1) IJKL=2                                             ML  614
C***  STORE BEST MODEL COEFFICIENTS                                     ML  615
      CALL FITERR(FIT,IJKL,CFM)                                         ML  616
      IF (LPRG.NE.1) GO TO 49                                           ML  617
C***  DETERMINE MAXIMUM PITCH ANGLE AND ANGLE OF ATTACK                 ML  618
      AMAX=F6(1)                                                        ML  619
      TMAX=F2(1)                                                        ML  620
      DO 48 I=1,K                                                       ML  621
      ALPHA(I)=F6(I)                                                    ML  622
      THETA(I)=F2(I)                                                    ML  623
      IF (DABS(F6(I)).GT.DABS(AMAX)) AMAX=F6(I)                         ML  624
   48 IF (DABS(F2(I)).GT.DABS(TMAX)) TMAX=F2(I)                         ML  625
C***  CHECK FIT ERROR                                                   ML  626
   49 IF (FIT(LPRG).LT.FITOK) GO TO 50                                  ML  627
C***  CALCULATE BIAS IN ANGLE OF ATTACK                                 ML  628
      CALL ABIAS(K,LPRG,FIT,HNB)                                        ML  629
      IF (IERR.NE.0) GO TO 1                                            ML  630
C***  UPDATE RATES FOR COMPATIBILITY                                    ML  631
   50 IF (IUP.EQ.0) GO TO 51                                            ML  632
      CALL FNI(K,P2,TIME,F3,DUM,1,15,3,0)                               ML  633
      CALL FNI(K,F6,TIME,F9,DUM,1,15,3,0)                               ML  634
C***  CALCULATE POWER, DRAG COEFFICIENT AND LIFT COEFFICIENT            ML  635
   51 SD2=S/2.0D0                                                       ML  636
      CALL CHNGE(SGN)                                                   ML  637
      DO 52 I=1,K                                                       ML  638
      PWRA(I)=CFM(1)+CFM(2)*F4(I)**EX1+CFM(3)*F4(I)**EX2+CFM(4)*F4(I)**E ML  639
     1X3+CFM(5)*F4(I)**EX4                                              ML  640
      AM=F6(I)                                                          ML  641
      IF (F6(I).LT.0.0D0) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)           ML  642
      CD(I)=CFM(6)+CFM(7)*SGN(1)*AM**IEX1+CFM(8)*SGN(2)*AM**IEX2+CFM(9)* ML  643
     1SGN(3)*AM**IEX3+CFM(10)*SGN(4)*AM**IEX4                           ML  644
      CL(I)=F1(I)/(SD2*F5(I)*F4(I)**2)*(DCOS(F2(I)-F6(I))+F4(I)*(F3(I)-F ML  645
     19(I))/G-DSIN(F6(I)+TIA)*PWRA(I)/(F4(I)*F1(I)))                    ML  646
      IF (F6(I).LT.0.0D0) CALL CHNGE(SGN)                               ML  647
      IF (FIT(LPRG).LT.FITOK.AND.IUP.EQ.0) FT1(I)=DARSIN(F11(I)/F4(I))  ML  648
   52 CONTINUE                                                          ML  649
C***  CHECK FIT ERROR AND BYPASS CODES                                  ML  650
      IF (ITERR.NE.0) GO TO 187                                         ML  651
      IF (FIT(LPRG).LT.FITOK.AND.IUP.EQ.0) GO TO 70                     ML  652
      IF (FIT(LPRG).LT.FITOK.AND.IUP.NE.0) GO TO 178                    ML  653
      IF (LPSS.NE.0) GO TO 140                                          ML  654
      LPSS=1                                                            ML  655
C***  CALCULATE FLIGHT-PATH ANGLE                                       ML  656
      DO 53 I=1,K                                                       ML  657
   53 FT1(I)=DARSIN(F11(I)/F4(I))                                       ML  658
C***  CALCULATE FLIGHT-PATH-ANGLE RATE OF CHANGE                        ML  659
      CALL FNI(K,FT1,TIME,FT2,DUM,1,15,3,0)                             ML  660
C***  SET UP LEAST-SQUARES COEFFICIENTS FOR 1/3 POWER TERM              ML  661
      DO 54 I=1,K                                                       ML  662
      C(I,1)=DCOS(F6(I)+TIA)/(F1(I)*F4(I))*F4(I)**0.33333D0             ML  663
      C(I,2)=-F5(I)*S*F4(I)**2/(2.0D0*F1(I))                            ML  664
      C(I,3)=C(I,2)*F6(I)                                               ML  665
      C(I,4)=C(I,3)*F6(I)                                               ML  666
      C(I,5)=C(I,4)*F6(I)                                               ML  667
      C(I,6)=C(I,5)*F6(I)                                               ML  668
   54 X(I,1)=F8(I)/G+DSIN(F2(I)-F6(I))                                  ML  669
C***  PERFORM LEAST SQUARES                                             ML  670
      CALL LLSQAR(C,X,K,6,1,450,450,15,WKAR,IER,JWRITE)                 ML  671
      IF (IER.EQ.129) WRITE (JWRITE,55)                                 ML  672
   55 FORMAT (1X,//,10X,'ZERO MATRIX ENCOUNTERED IN LEAST SQUARES.  TO B ML  673
     1EXT DATA SET, IF ANY.')                                           ML  674
      IF (IER.EQ.129) GO TO 1                                           ML  675
C***  DETERMINE FIT ERROR                                               ML  676
      TMF=0.0D0                                                         ML  677
      DO 56 I=1,K                                                       ML  678
      XMF=DCOS(F6(I)+TIA)*(X(1,1)*F4(I)**0.33333D0)/(F1(I)*F4(I))-(F5(I) ML  679
     1*S*F4(I)**2/(2.0D0*F1(I)))*(X(2,1)+X(3,1)*F6(I)+X(4,1)*F6(I)*F6(I)+ ML  680
     1X(5,1)*F6(I)*F6(I)*F6(I)+X(6,1)*F6(I)*F6(I)*F6(I)*F6(I))*F8(I)/G*D ML  681
     1SIN(F2(I)-F6(I)))                                                 ML  682
   56 TMF=TMF+XMF*XMF                                                   ML  683
C***  WRITE COEFFICIENTS AND FIT ERROR                                  ML  684
      IF (METRIC.NE.0) GO TO 58                                         ML  685
      WRITE (JWRITE,57) (X(I,1),I=1,6),TMF                              ML  686
   57 FORMAT (1X,//,13X,106('*'),/,13X,'*',104X,'*',/,13X,'*',18X,'INITI ML  687
     1ALIZATION OF COEFFICIENT CONVERGENCE SCHEME BY 1/3 POWER MODEL',19 ML  688
     1X,'*',/,13X,'*',104X,'*',/,13X,'*',1X,'FORM:',2X,'F = ',1PD12.5,'* ML  689
     1V**1/3',73X,'*',/,13X,'*',104X,'*',/,13X,'*',8X,'CD= ',1PD12.5,' + ML  690
     1 ',1PD12.5,'*A + ',1PD12.5,'*A**2 + ',1PD12.5,'*A**3 + ',1PD12.5,' ML  691
     1*A**4',3X,'*',/,13X,'*',104X,'*',/,13X,'*',10X,'WHERE:  V = AIRSPE ML  692
     1ED(FT/SEC) ',66X,'*',/,13X,'*',18X,'A = ANGLE OF ATTACK(RADIAN) ',59 ML  693
     1X,'*',/,13X,'*',104X,'*',/,13X,'* FIT ERROR = ',D16.9,75X,'*',/,13 ML  694
     1X,'*',104X,'*',/,13X,106('*'))                                    ML  695
      GO TO 60                                                          ML  696
   58 CF1=X(1,1)*1.3558180-3                                            ML  697
      WRITE (JWRITE,59) CF1,(X(I,1),I=2,6),TMF                          ML  698
   59 FORMAT (1X,//,13X,106('*'),/,13X,'*',104X,'*',/,13X,'*',18X,'INITI ML  699
     1ALIZATION OF COEFFICIENT CONVERGENCE SCHEME BY 1/3 POWER MODEL',19 ML  700
     1X,'*',/,13X,'*',104X,'*',/,13X,'*',1X,'FORM:',2X,'F = ',1PD12.5,'* ML  701
     1V**1/3',73X,'*',/,13X,'*',104X,'*',/,13X,'*',8X,'CD= ',1PD12.5,' + ML  702
     1 ',1PD12.5,'*A + ',1PD12.5,'*A**2 + ',1PD12.5,'*A**3 + ',1PD12.5,' ML  703
     1*A**4',3X,'*',/,13X,'*',104X,'*',/,13X,'*',10X,'WHERE:  V = AIRSPE ML  704
     1ED(M/SEC) ',66X,'*',/,13X,'*',18X,'A = ANGLE OF ATTACK(RADIAN) ',59 ML  705
     1X,'*',/,13X,'*',104X,'*',/,13X,'* FIT ERROR = ',D16.9,75X,'*',/,13 ML  706
     1X,'*',104X,'*',/,13X,106('*'))                                    ML  707
   60 CF1=X(1,1)                                                        ML  708
C***  CHECK FOR FURTHER IMPROVEMENT                                     ML  709
      IF (TMF.GT.(5*FIT(LPRG))) GO TO 72                                ML  710
C***  COMPUTE LIFT COEFFICIENT BASED ON 1/3 POWER MODEL AND EXTRACT NEW ML  711
C***  COEFFICIENTS UNTIL CONVERGENCE                                    ML  712
      ITER=0                                                            ML  713
   61 DO 62 I=1,K                                                       ML  714
      W=F1(I)                                                           ML  715
      V=F4(I)                                                           ML  716
      R=F5(I)                                                           ML  717
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      A=F6(I)                                                           NL  718
      DV=F8(I)                                                          NL  719
      HD=F11(I)                                                         NL  720
      DUM(I)=2.0D0*W/(G*S*R*V)*(FT2(I)*G*DCOS(FT1(I))/V-G*DSIN(A+TIA)*CF NL  721
     11*V**0.33333D0/(W*V*V))                                           NL  722
      C(I,1)=DCOS(A+TIA)/(W*V)*V**0.33333D0                             NL  723
      C(I,2)=-R*S*V*V/(2.0D0*W)                                         NL  724
      C(I,3)=C(I,2)*DUM(I)                                              NL  725
      C(I,4)=C(I,3)*DUM(I)                                              NL  726
   62 X(I,1)=DV/G*DSIN(F2(I)-F6(I))                                     NL  727
C***  STORE VALUES FOR COMPARISON                                       NL  728
      IF (ITER.EQ.0) GO TO 63                                           NL  729
      SX1=CF1                                                           NL  730
      SX2=CF2                                                           NL  731
      SX3=CF3                                                           NL  732
      SX4=CF4                                                           NL  733
C***  PERFORM LEAST SQUARES                                             NL  734
   63 CALL LLSQAR(C,X,K,4,1,450,450,15,WKAR,IER,JWRITE)                 NL  735
      IF (IER.EQ.129) WRITE (JWRITE,55)                                 NL  736
      IF (IER.EQ.129) GO TO 1                                           NL  737
C***  COMPUTE FIT ERROR                                                 NL  738
      TSX=0.0D0                                                         NL  739
      DO 64 I=1,K                                                       NL  740
      W=F1(I)                                                           NL  741
      V=F4(I)                                                           NL  742
      R=F5(I)                                                           NL  743
      A=F6(I)                                                           NL  744
      DV=F8(I)                                                          NL  745
      HD=F11(I)                                                         NL  746
      XSX=DCOS(A+TIA)*X(1,1)*V**0.33333D0/(W*V)-(R*S*V*V/(2.0D0*W)*(X(2, NL  747
     11)*X(3,1)*DUM(I)*X(4,1)*DUM(I)*DUM(I))*DV/G*DSIN(F2(I)-F6(I)))    NL  748
   64 TSX=TSX+XSX*XSX                                                   NL  749
C***  TEST FOR CONVERGENCE                                              NL  750
      IF (ITER.EQ.0) GO TO 68                                           NL  751
      LLL=0                                                             NL  752
      IF (DABS(SX1-X(1,1)).LT.1.0D-06) LLL=LLL+1                        NL  753
      IF (DABS(SX2-X(2,1)).LT.1.0D-06) LLL=LLL+1                        NL  754
      IF (DABS(SX3-X(3,1)).LT.1.0D-06) LLL=LLL+1                        NL  755
      IF (DABS(SX4-X(4,1)).LT.1.0D-06) LLL=LLL+1                        NL  756
C***  WRITE COEFFICIENTS                                                NL  757
      IF (METRIC.NE.0) GO TO 66                                         NL  758
      WRITE (JWRITE,65) SX1,X(1,1),ITER,SX2,X(2,1),LLL,SX3,X(3,1),TSX,SX NL  759
     14,X(4,1)                                                          NL  760
   65 FORMAT (25X,83('*'),/,25X,'*',39X,'*',8X,'PAST',15X,'PRESENT',7X,' NL  761
     1*',/,25X,'*',39X,'*',1X,1PD18.11,3X,1PD18.11,1X,'*',/,25X,'* COEFF NL  762
     1ICIENT CONVERGENCE ITERATION #',I2,' . ',1PD18.11,3X,1PD18.11,' .' NL  763
     1,/,25X,'* NUMBER OF COEFFICIENTS PASSED =',I2,5X,'. ',1PD18.11,3X, NL  764
     11PD18.11,' .',/,25X,'* FIT ERROR = ',1PD20.13,6X,'. ',1PD18.11,3X, NL  765
     11PD18.11,' .',/,25X,83('*'))                                      NL  766
      GO TO 67                                                          NL  767
   66 P0=SX1*1.3558180-3                                                NL  768
      P1=X(1,1)*1.3558180-3                                             NL  769
      WRITE (JWRITE,65) P0,P1,ITER,SX2,X(2,1),LLL,SX3,X(3,1),XSX,SX4,X(4 NL  770
     1,1)                                                               NL  771
   67 IF (LLL.EQ.4) GO TO 70                                            NL  772
   68 ITER=ITER+1                                                       NL  773
      IF (ITER.GT.20) GO TO 70                                          NL  774
      CF1=X(1,1)                                                        NL  775
      CF2=X(2,1)                                                        NL  776
      CF3=X(3,1)                                                        NL  777
      CF4=X(4,1)                                                        NL  778
      WRITE (JWRITE,69)                                                 NL  779
   69 FORMAT (77X,'*',/,77X,'*',/,75X,5('*'),/,76X,'* *',/,77X,'*')     NL  780
      GO TO 61                                                          NL  781
   70 IF (FIT(LPRG).LT.FITOK) GO TO 72                                  NL  782
      DO 71 I=1,K                                                       NL  783
   71 CL(I)=DUM(I)                                                      NL  784
C***  OBTAIN INITIAL ESTIMATES ON LIFT COEFFICIENTS                     NL  785
   72 INTST=0                                                           NL  786
      EFFX=2.0D0                                                        NL  787
      GO TO 86                                                          NL  788
   73 INTST=1                                                           NL  789
      CALL LLSQAR(C,X,K,N,1,450,450,15,WKAR,IER,JWRITE)                 NL  790
      IF (IER.EQ.129) WRITE (JWRITE,55)                                 NL  791
      IF (IER.EQ.129) GO TO 1                                           NL  792
C***  INITIALIZE LEAST-SQUARE-DISTANCE COEFFICIENTS                     NL  793
      INTST=0                                                           NL  794
      GO TO 104                                                         NL  795
   74 INTST=1                                                           NL  796
      AL(1)=CFM(11)                                                     NL  797
      AL(2)=CFM(12)                                                     NL  798
      AL(3)=CFM(13)                                                     NL  799
      AL(4)=2.0D0                                                       NL  800
      HCLQ=CFM(14)                                                      NL  801
C***  PRINT OUT ESTIMATES                                               NL  802
      WRITE (JWRITE,75) (AL(I),I=1,4),CFM(14)                           NL  803
   75 FORMAT (1X,///,48X,'INITIAL ESTIMATES OF LIFT COEFFICIENTS',//,53X NL  804
     1,'CLA0=',D23.16,/,53X,'CLA =',D23.16,/,53X,'CLAX=',D23.16,/,53X,'2 NL  805
     1EPX=',D23.16,/,53X,'CLQ =',D23.16,/)                              NL  806
C***  CHECK LIFT FUNCTION CODE FOR DETERMINATION OF NUMBER OF UNKNOWNS  NL  807
      N=NLLS(MTH+1)                                                     NL  808
      IF (MCLCC.NE.0)N=NLSD(MTH+1)                                      NL  809
      IF (MCLCC.EQ.0) GO TO 87                                          NL  810
C***  ADJUST CL'S, IF NECESSARY, FOR PITCH RATE DEPENDENCY              NL  811
   76 IF ((MTH.EQ.0.OR.MTH.EQ.2).OR.MTH.EQ.4) GO TO 78                  NL  812
      DO 77 I=1,K                                                       NL  813
   77 CL(I)=CL(I)-CFM(14)*F3(I)                                         NL  814
C***  ORDER DATA FOR DETERMINING LIFT COEFFICIENTS                      NL  815
   78 CALL ASCEN(K,CL,F6,X1,X2)                                         NL  816
C***  CHECK FOR NEGATIVE OR ZERO X2'S                                   NL  817
      JJ=0                                                              NL  818
      DO 79 I=1,K                                                       NL  819
      IF (X2(I).GT.0.0D0) GO TO 80                                      NL  820
   79 JJ=JJ+1                                                          NL  821
   80 KM=K-JJ                                                           NL  822
      IF (KM.EQ.K) GO TO 83                                             NL  823
C***  STORE VALUES FOR LATTER COMPUTATION                               NL  824
      DO 81 I=1,JJ                                                      NL  825
      WKAR(I+JJ)=X2(I)                                                  NL  826
   81 WKAR(I+JJ)=X1(I)                                                  NL  827
C***  ADJUST REMAINING POINTS FOR LEAST-SQUARE DISTANCE                 NL  828
      DO 82 I=1,KM                                                      NL  829
      X1(I)=X1(JJ+I)                                                    NL  830
   82 X2(I)=X2(JJ+I)                                                    NL  831
   83 LM=0                                                              NL  832
C***  PERFORM LEAST-SQUARE-DISTANCE FIT                                 NL  833
      CALL LSD(X2,X1,KM,AL,N,RMS,LM,IERR,JWRITE,MTH)                    NL  834
      IF (LM.NE.0) GO TO 84                                             NL  835
      ICD=1                                                             NL  836
      CFM(11)=AL(1)                                                     NL  837
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      CFM(12)=AL(2)                                                     NL  838
      CFM(13)=AL(3)                                                     NL  839
      EXPX=AL(4)                                                        NL  840
C***  COMPUTE INTERCEPT                                                 NL  841
      IF (JJ.EQ.0) GO TO 114                                            NL  842
      YCEPT=MKAR(JJ+JJ)-CFM(12)*MKAR(JJ)                                NL  843
      GO TO 114                                                         NL  844
C***  DEFAULT TO LINEAR LEAST-SQUARES FIT                               NL  845
   84 IF ((MTH.EQ.0.OR.MTH.EQ.2).OR.MTH.EQ.4) GO TO 86                  NL  846
      DO 85 I=1,K                                                       NL  847
   85 CL(I)=CL(I)+CFM(14)*F3(I)                                         NL  848
   86 N=NLLS(MTH+1)                                                     NL  849
C***  PERFORM LINEAR LEAST-SQUARES FIT                                  NL  850
   87 MTHP1=MTH+1                                                       NL  851
      DO 94 I=1,K                                                       NL  852
      IF (F6(I).LE.0.0.AND.MTH.GE.2) GO TO 95                           NL  853
      C(I,1)=1.0D0                                                      NL  854
      GO TO (88,89,90,91,92,93),MTHP1                                   NL  855
   88 C(I,2)=F6(I)                                                      NL  856
      GO TO 94                                                          NL  857
   89 C(I,2)=F6(I)                                                      NL  858
      C(I,3)=F3(I)                                                      NL  859
      GO TO 94                                                          NL  860
   90 C(I,2)=F6(I)                                                      NL  861
      C(I,3)=F6(I)**EXPX                                                NL  862
      GO TO 94                                                          NL  863
   91 C(I,2)=F6(I)                                                      NL  864
      C(I,3)=F6(I)**EXPX                                                NL  865
      C(I,4)=F3(I)                                                      NL  866
      GO TO 94                                                          NL  867
   92 C(I,2)=F6(I)**EXPX                                                NL  868
      GO TO 94                                                          NL  869
   93 C(I,2)=F6(I)**EXPX                                                NL  870
      C(I,3)=F3(I)                                                      NL  871
   94 X(I,1)=CL(I)                                                      NL  872
      IF (INTST.EQ.0) GO TO 73                                          NL  873
      ICD=2                                                             NL  874
      GO TO 103                                                         NL  875
   95 EXPX=2.0D0                                                        NL  876
      DO 102 I=1,K                                                      NL  877
      C(I,1)=1.0D0                                                      NL  878
      GO TO (96,97,98,99,100,101),MTHP1                                 NL  879
   96 C(I,2)=F6(I)                                                      NL  880
      GO TO 102                                                         NL  881
   97 C(I,2)=F6(I)                                                      NL  882
      C(I,3)=F3(I)                                                      NL  883
      GO TO 102                                                         NL  884
   98 C(I,2)=F6(I)                                                      NL  885
      C(I,3)=F6(I)*F6(I)                                                NL  886
      GO TO 102                                                         NL  887
   99 C(I,2)=F6(I)                                                      NL  888
      C(I,3)=F6(I)*F6(I)                                                NL  889
      C(I,4)=F3(I)                                                      NL  890
      GO TO 102                                                         NL  891
  100 C(I,2)=F6(I)*F6(I)                                                NL  892
      GO TO 102                                                         NL  893
  101 C(I,2)=F6(I)*F6(I)                                                NL  894
      C(I,3)=F3(I)                                                      NL  895
  102 X(I,1)=CL(I)                                                      NL  896
      IF (INTST.EQ.0) GO TO 73                                          NL  897
      ICD=3                                                             NL  898
  103 CALL LLSQAR(C,X,K,N,1,450,450,15,MKAR,IER,JWRITE)                 NL  899
      IF (IER.EQ.129) WRITE (JWRITE,55)                                 NL  900
      IF (IER.EQ.129) GO TO 1                                           NL  901
  104 CFM(11)=X(1,1)                                                    NL  902
      DO 105 I=12,14                                                    NL  903
  105 CFM(I)=0.0D0                                                      NL  904
      GO TO (106,107,108,109,110,111),MTHP1                             NL  905
  106 CFM(12)=X(2,1)                                                    NL  906
      GO TO 112                                                         NL  907
  107 CFM(12)=X(2,1)                                                    NL  908
      CFM(14)=X(3,1)                                                    NL  909
      GO TO 112                                                         NL  910
  108 CFM(12)=X(2,1)                                                    NL  911
      CFM(13)=X(3,1)                                                    NL  912
      GO TO 112                                                         NL  913
  109 CFM(12)=X(2,1)                                                    NL  914
      CFM(13)=X(3,1)                                                    NL  915
      CFM(14)=X(4,1)                                                    NL  916
      GO TO 112                                                         NL  917
  110 CFM(13)=X(2,1)                                                    NL  918
      GO TO 112                                                         NL  919
  111 CFM(13)=X(2,1)                                                    NL  920
      CFM(14)=X(3,1)                                                    NL  921
  112 LN=0                                                              NL  922
      IF (INTET.EQ.0) GO TO 74                                          NL  923
C***  WRITE OUT LIFT COEFFICIENTS                                       NL  924
      WRITE (JWRITE,113)                                                NL  925
  113 FORMAT (1X,//,48X,'LIFT COEFFICIENTS: BY LINEAR LEAST SQUARES',/) NL  926
      GO TO 116                                                         NL  927
  114 WRITE (JWRITE,115)                                                NL  928
  115 FORMAT (1X,//,48X,'LIFT COEFFICIENTS: BY LEAST SQUARE DISTANCE',/) NL  929
  116 WRITE (JWRITE,117) CFM(11),CFM(12),CFM(13),EXPX,CFM(14)           NL  930
  117 FORMAT (53X,'CLAO=',D23.16,/,53X,'CLA =',D23.16,/,53X,'CLAX=',D23. NL  931
     116,/,53X,'EXPX=',D23.16,/,53X,'CLQ=',D23.16,//)                   NL  932
C***  CHECK PROGRAM DIRECTION                                           NL  933
      IF (IPATH.NE.0) GO TO 150                                         NL  934
C***  CHECK FIT ERROR                                                   NL  935
      TFX=0.0D0                                                         NL  936
      DO 123 I=1,K                                                      NL  937
      GO TO (118,120,121),ICD                                           NL  938
  118 IF (F6(I).GT.0.0D0) GO TO 119                                     NL  939
      CLX=CFM(12)*F6(I)+YCEPT+HCLQ*F3(I)                                NL  940
      CL(I)=CL(I)+HCLQ*F3(I)                                            NL  941
      GO TO 122                                                         NL  942
  119 CLX=CFM(11)+CFM(12)*F6(I)+CFM(13)*F6(I)**EXPX+HCLQ*F3(I)          NL  943
      CL(I)=CL(I)+HCLQ*F3(I)                                            NL  944
      GO TO 122                                                         NL  945
  120 CLX=CFM(11)+CFM(12)*F6(I)+CFM(13)*F6(I)**EXPX+CFM(14)*F3(I)       NL  946
      GO TO 122                                                         NL  947
  121 CLX=CFM(11)+CFM(12)*F6(I)+CFM(13)*F6(I)*F6(I)+CFM(14)*F3(I)       NL  948
  122 XFX=CL(I)-CLX                                                     NL  949
  123 TFX=TFX+XFX*XFX                                                   NL  950
      WRITE (JWRITE,124) TFX                                            NL  951
  124 FORMAT (53X,'LIFT COEFFICIENT FIT ERROR= ',D23.16,//)             NL  952
C***  CHECK FOR A BYPASS                                                NL  953
      IF (FIT(LPRG).LT.FITOK) GO TO 178                                 NL  954
      IF (TNF.GT.(5*FIT(LPRG))) GO TO 140                               NL  955
C***  READJUST ANGLE OF ATTACK BY NEWTON-RAPHSON ON LIFT EXPRESSION     NL  956
      NCNT=0                                                            NL  957
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      DO 137 I=1,K                                                      ML  958
      ICNT=0                                                            ML  959
      A=F6(I)                                                           ML  960
      X2(I)=A                                                           ML  961
      X1(I)=CL(I)                                                       ML  962
  125 ICNT=ICNT+1                                                       ML  963
      GO TO (126,127,128),ICD                                           ML  964
  126 IF (A.GT.0.0D0) GO TO 127                                         ML  965
      XX=CFN(12)*A*YCEPT*HCLQ*P3(I)-CL(I)                               ML  966
      XP=CFN(12)                                                        ML  967
      XPP=0.0D0                                                         ML  968
      GO TO 129                                                         ML  969
  127 XX=CFN(11)+CFN(12)*A+CFN(13)*A**EXPX+CFN(14)*P3(I)-CL(I)          ML  970
      XP=CFN(12)+EXPX*CFN(13)*A**(EXPX-1.0D0)                           ML  971
      XPP=EXPX*(EXPX-1.0D0)*A**(EXPX-2.0D0)                             ML  972
      GO TO 129                                                         ML  973
  128 XX=CFN(11)+CFN(12)*A+CFN(13)*A*A+CFN(14)*P3(I)-CL(I)              ML  974
      XP=CFN(12)+2*CFN(13)*A                                            ML  975
      XPP=2*CFN(13)                                                     ML  976
  129 RAD=(XP/XPP)*(XP/XPP)-2.0D0*(XX/XPP)                              ML  977
      A1=A                                                              ML  978
      IF (RAD.LT.0.0D0) GO TO 131                                       ML  979
      IF ((XP*XPP).LT.0.0D0) GO TO 130                                  ML  980
      A=A-XP/XPP+DSQRT(RAD)                                             ML  981
      GO TO 132                                                         ML  982
  130 A=A-XP/XPP-DSQRT(RAD)                                             ML  983
      GO TO 132                                                         ML  984
  131 A=A-XP/XPP                                                        ML  985
      MCNT=MCNT+1                                                       ML  986
      GO TO 133                                                         ML  987
  132 IF (DABS(A1-A).LT.1.0D-15.OR.ICNT.EQ.20) GO TO 133                ML  988
      GO TO 125                                                         ML  989
  133 F6(I)=A                                                           ML  990
C***  COMPUTE NEW LIFT COEFFICIENT                                      ML  991
      GO TO (134,135,136),ICD                                           ML  992
  134 IF (A.GT.0.0D0) GO TO 135                                         ML  993
      CL(I)=CFN(12)*A*YCEPT*HCLQ*P3(I)                                  ML  994
      GO TO 137                                                         ML  995
  135 CL(I)=CFN(11)+CFN(12)*A+CFN(13)*A**EXPX+CFN(14)*P3(I)             ML  996
      GO TO 137                                                         ML  997
  136 CL(I)=CFN(11)+CFN(12)*A+CFN(13)*A*A+CFN(14)*P3(I)                 ML  998
  137 CONTINUE                                                          ML  999
      IF (MCNT.NE.0) WRITE (JWRITE,138) MCNT                            ML 1000
  138 FORMAT (1X,//,9X,94H**** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK ML 1001
     1IN  MAIN , ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)    ML 1002
C***  PERFORM MODEL EXTRACTION                                          ML 1003
      CALL MODEL(K,LPNG,FIT,MNB)                                        ML 1004
      IF (IERR.NE.0) GO TO 1                                            ML 1005
      IUP=1                                                             ML 1006
      IF (FIT(LPNG).LT.FITOK) GO TO 50                                  ML 1007
C***  TEST FOR IMPROVEMENT                                              ML 1008
      SX=FIT(LPNG)                                                      ML 1009
      CALL FITERR(FIT,2,CFN)                                            ML 1010
      IF (FIT(LPNG).EQ.SX) GO TO 140                                    ML 1011
C***  REDEFINE ANGLE OF ATTACK AND LIFT COEFFICIENTS                    ML 1012
      DO 139 I=1,K                                                      ML 1013
      F6(I)=X2(I)                                                       ML 1014
  139 CL(I)=X1(I)                                                       ML 1015
C***  PERFORM FREQUENCY-DEPENDENT CORRECTIONS TO ANGLE OF ATTACK        ML 1016
  140 CALL ALPDEL(K,LPNG,MNB,FIT)                                       ML 1017
      IF (IERR.NE.0) GO TO 1                                            ML 1018
C***  CHECK FIT ERROR                                                   ML 1019
      IUP=1                                                             ML 1020
  141 IF (FIT(LPNG).LT.FITOK) GO TO 50                                  ML 1021
C***  INTERMEDIATE PRINTOUT OF POWER, DRAG, AND LIFT COEFFICIENTS       ML 1022
      WRITE (JWRITE,142) EX1,EX2,EX3,SX4,IEX1,IEX2,IEX3,IEX4,EXPX       ML 1023
  142 FORMAT (1X,///,16X,100('*'),/,16X,'*',98(' '),'*',/,16X,'*',96X,' ML 1024
     1*',/,16X,'*',2X,'INTERMEDIATE',4X,'GENERAL EXPRESSIONS FOR POWER ML 1025
     1, DRAG COEFFICIENT, AND LIFT COEFFICIENT',9X,'*',/,16X,'*',96X,' ML 1026
     1*',/,16X,'*',96X,'*',/,16X,'*',3X,'P = P0 + P1*V**',1PD12.5,'   ML 1027
     1+ P2*V**',1PD12.5,' + P3*V**',1PD12.5,' + P4*V**',1PD12.5,3X,'*',/, ML 1028
     1/,16X,'*',96X,'*',/,16X,'*',20X,'CD = CD0 + CD1*A**',I2,' + CD2  ML 1029
     1*A**',I2,' + CD3*A**',I2,' + CD4*A**',I2,20X,'*',/,16X,'*',96X,' ML 1030
     1*',/,16X,'*',24X,'CL = CLA0 + CLA*A + CLAX*A**',1PD12.5,' + CLQ* ML 1031
     1R',24X,'*',/,16X,'*',96X,'*',/,16X,'*',96X,'*',/,16X,'*',3X,     ML 1032
     1'WHERE:',87X,'*',/,16X,'*',96X,'*')                               ML 1033
      IF (METRIC.NE.0) GO TO 144                                        ML 1034
      WRITE (JWRITE,143)                                                ML 1035
  143 FORMAT (16X,'*',11X,'V = AIRSPEED(FT/SEC)',65X,'*',/,16X,'*',11   ML 1036
     1X,'A = ANGLE OF ATTACK(RADIAN)',58X,'*',/,16X,'*',11X,'R = PITCH  ML 1037
     1 RATE(RADIAN/SEC)',59X,'*',/,16X,'*',96X,'*')                     ML 1038
      GO TO 146                                                         ML 1039
  144 WRITE (JWRITE,145)                                                ML 1040
  145 FORMAT (16X,'*',11X,'V = AIRSPEED(M/SEC)',66X,'*',/,16X,'*',11X   ML 1041
     1,'A = ANGLE OF ATTACK(RADIAN)',58X,'*',/,16X,'*',11X,'R = PITCH   ML 1042
     1RATE(RADIAN/SEC)',59X,'*',/,16X,'*',96X,'*')                      ML 1043
      GO TO 148                                                         ML 1044
  146 WRITE (JWRITE,147) CFN(1),CFN(6),CFN(11),CFN(2),CFN(7),CFN(12),CFN ML 1045
     1(3),CFN(8),CFN(13),CFN(4),CFN(9),CFN(14),CFN(5),CFN(10)           ML 1046
  147 FORMAT (16X,'*',9X,'P0 = ',D18.11,3X,'CD0 = ',D18.11,3X,'CLA0 = ' ML 1047
     1,D18.11,9X,'*',/,16X,'*',9X,'P1 = ',D18.11,3X,'CD1 = ',D18.11,3X  ML 1048
     1,'CLA  = ',D18.11,9X,'*',/,16X,'*',9X,'P2 = ',D18.11,3X,'CD2 = ' ML 1049
     1,D18.11,3X,'CLAX = ',D18.11,9X,'*',/,16X,'*',9X,'P3 = ',D18.11,3 ML 1050
     1X,'CD3 = ',D18.11,3X,'CLQ  = ',D18.11,9X,'*',/,16X,'*',9X,'P4 =  ML 1051
     1',D18.11,3X,'CD4 = ',D18.11,37X,'*',/,16X,'*',96X,'*',/,16X,'*'/ ML 1052
     1,98('*'),'*',/,16X,100('*'),///)                                  ML 1053
      GO TO 149                                                         ML 1054
  148 P0=CFN(1)*1.355818D-3                                             ML 1055
      P1=CFN(2)*1.355818D-3                                             ML 1056
      P2=CFN(3)*1.355818D-3                                             ML 1057
      P3=CFN(4)*1.355818D-3                                             ML 1058
      P4=CFN(5)*1.355818D-3                                             ML 1059
      WRITE (JWRITE,147) P0,CFN(6),CFN(11),P1,CFN(7),CFN(12),P2,CFN(8),C ML 1060
     1FN(13),P3,CFN(9),CFN(14),P4,CFN(10)                               ML 1061
C***  WRITE OUT INTERMEDIATE RESULTS                                    ML 1062
  149 ISW=1                                                             ML 1063
      GO TO 25                                                          ML 1064
C***  PERFORM PATH PERFORMANCE ASSUMING AIRSPEED AND ALTITUDE GIVEN     ML 1065
  150 IPATH=IPATH+1                                                     ML 1066
      KM1=K-1                                                           ML 1067
C***  COMPUTE SPECIFIC FUEL CONSUMPTION                                 ML 1068
      SFC=0.0D0                                                         ML 1069
      DO 151 I=1,KM1                                                    ML 1070
      V=EV(I)                                                           ML 1071
      PX=CFN(1)+CFN(2)*V**EX1+CFN(3)*V**EX2+CFN(4)*V**EX3+CFN(5)*V**EX4 ML 1072
  151 SFC=SFC+(F1(I)+F1(I+1))/(TIME(I+1)-TIME(I))/PX                    ML 1073
      CSFC=SFC/KM1                                                      ML 1074
C***  WRITE SPECIFIC FUEL CONSUMPTION                                   ML 1075
      IF (METRIC.NE.0) GO TO 153                                        ML 1076
      WRITE (JWRITE,152) CSFC                                           ML 1077
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  152 FORMAT (1X,////,27X,38HESTIMATED SPECIFIC FUEL CONSUMPTION = ,1PD2 ML 1078
     10.13,21H LBF/(FT-LBF/SEC)/SEC,//)                                 ML 1079
         GO TO 155                                                       ML 1080
  153 SCSFC=CSFC*4448.2D0/1.3558D0                                       ML 1081
         WRITE (JWRITE,154) SCSFC                                        ML 1082
  154 FORMAT (1X,////,27X,38HESTIMATED SPECIFIC FUEL CONSUMPTION = ,1PD2 ML 1083
     10.13,9H N/KW-SEC)                                                  ML 1084
  155 IF (CSFC.LE.0.0D0) WRITE (JWRITE,156)                              ML 1085
  156 FORMAT (1X,/,27X,'SPECIFIC FUEL CONSUMPTION IS NEGATIVE OR ZERO. T ML 1086
     1O NEXT DATA SET, IF ANY.')                                         ML 1087
C***  TEST MAGNITUDE OF CSFC                                            ML 1088
         IF (CSFC.LE.0.0D0) GO TO 1                                      ML 1089
         IF (CSFC.GT.0.4D-06)CSFC=0.4D-06                                ML 1090
         IF (CSFC.LT.0.4D-07)CSFC=0.4D-07                                ML 1091
         IF (METRIC.NE.0) GO TO 157                                      ML 1092
         IF (CSFC.EQ.0.4D-06.OR.CSFC.EQ.0.4D-07) WRITE (JWRITE,152) CSFC ML 1093
         GO TO 158                                                       ML 1094
  157 SCSFC=CSFC*4448.2D0/1.3558D0                                       ML 1095
         IF (CSFC.EQ.0.4D-06.OR.CSFC.EQ.0.4D-07) WRITE (JWRITE,154) SCSFC ML 1096
C***  STORE PARAMETERS                                                  ML 1097
  158 IF (IPATH.EQ.1) GO TO 159                                          ML 1098
         IF (FIT(LPRG).GT.WRK(1)) GO TO 162                              ML 1099
  159 WRK(1)=FIT(LPRG)                                                   ML 1100
         WRK(2)=CSFC                                                     ML 1101
         WRK(3)=EXPI                                                     ML 1102
         DO 160 I=1,14                                                   ML 1103
  160 WRK(I+3)=CFM(I)                                                    ML 1104
         DO 161 I=1,K                                                    ML 1105
         WRK(I+17)=F1(I)                                                 ML 1106
         WRK(I+17+K)=F2(I)                                               ML 1107
  161 WRK(I+17+K+K)=F6(I)                                                ML 1108
C***  CHECK FOR MAXIMUM ITERATION                                       ML 1109
  162 IF (IPATH.GE.7) GO TO 168                                          ML 1110
C***  ENACT PATH PERFORMANCE ROUTINE                                    ML 1111
         CALL PATH(K,CSFC,IPATH)                                         ML 1112
         IF (IERR.NE.0) GO TO 1                                          ML 1113
C***  CHECK FOR PITCH ANGLE MODIFICATION                                ML 1114
         IF (IPATH.GE.2)ISPT=1                                           ML 1115
C***  ADJUST ANGLE OF ATTACK AND PITCH ANGLE                            ML 1116
         FAC=0.5D0                                                       ML 1117
         DO 165 I=1,K                                                    ML 1118
         IF (IPATH.GE.3)FAC=-0.5D0                                       ML 1119
         F6(I)=F6(I)+FAC*ADF(I)                                          ML 1120
         IF (ISPT.NE.0)F2(I)=F6(I)+FT1(I)                                ML 1121
         IF (I.EQ.1) GO TO 165                                           ML 1122
         DW=F1(I)-F1(I-1)                                                ML 1123
         IF (DABS(DW).LT.0.0001D0) GO TO 163                             ML 1124
         GO TO 165                                                       ML 1125
  163 WRITE (JWRITE,164)                                                 ML 1126
  164 FORMAT (1X,////,10X,'CONSECUTIVE WEIGHT POINTS FAILED TO CHANGE BY ML 1127
     1MINIMUM ALLOWANCE. TO NEXT DATA SET, IF ANY.')                     ML 1128
         GO TO 1                                                         ML 1129
  165 CONTINUE                                                           ML 1130
C***  ADJUST PITCH ANGLE                                                ML 1131
         CALL GAMX(K)                                                    ML 1132
C***  PERFORM MODEL EXTRACTION                                          ML 1133
         CALL MODEL(K,LPRG,FIT,NWB)                                      ML 1134
C***  CHECK FOR APPROACHING MAXIMUM ITERATION                           ML 1135
         IF (IPATH.LE.5) GO TO 166                                       ML 1136
         IPATH=IPATH+1                                                   ML 1137
C***  UPDATE LIFT COEFFICIENTS                                          ML 1138
  166 DO 167 I=1,K                                                       ML 1139
         V=F6(I)                                                         ML 1140
         PX=CFM(1)+CFM(2)*V**EX1+CFM(3)*V**EX2+CFM(4)*V**EX3+CFM(5)*V**EX4 ML 1141
  167 CL(I)=(2.0D0*F1(I)/(F5(I)*S*V*G))*(PT2(I)*G+DCOS(PT1(I))/V-G*PX*DS ML 1142
     1IN(F6(I)+TIA)/(F1(I)*V**2))                                        ML 1143
         GO TO 76                                                        ML 1144
C***  DEFINE BEST PARAMETERS                                            ML 1145
  168 FIT(LPRG)=WRK(1)                                                   ML 1146
         CSFC=WRK(2)                                                     ML 1147
         EXPI=WRK(3)                                                     ML 1148
         DO 169 I=1,14                                                   ML 1149
  169 CFM(I)=WRK(I+3)                                                    ML 1150
         DO 170 I=1,K                                                    ML 1151
         F1(I)=WRK(I+17)                                                 ML 1152
         F2(I)=WRK(I+17+K)                                               ML 1153
  170 F6(I)=WRK(I+17+K+K)                                                ML 1154
C***  WRITE PARAMETERS                                                  ML 1155
         IF (METRIC.NE.0) GO TO 172                                      ML 1156
         WRITE (JWRITE,171) FIT(LPRG),CSFC                               ML 1157
  171 FORMAT (1X,///,15X,25H'BEST' MODEL FIT ERROR = ,1PD23.16,/,15X,35H ML 1158
     1'BEST' SPECIFIC FUEL CONSUMPTION = ,1PD20.13,21H LBF/(FT-LBF/SEC)/ ML 1159
     1SEC)                                                               ML 1160
         GO TO 141                                                       ML 1161
  172 SCSFC=CSFC*4448.2D0/1.3558D0                                       ML 1162
         WRITE (JWRITE,173) FIT(LPRG),SCSFC                              ML 1163
  173 FORMAT (1X,///,15X,25H'BEST' MODEL FIT ERROR = ,1PD23.16,/,15X,35H ML 1164
     1'BEST' SPECIFIC FUEL CONSUMPTION = ,1PD20.13,9H N/KW-SEC)          ML 1165
         GO TO 141                                                       ML 1166
C***  ENACT TRAJECTORY PREDICTION ROUTINE                               ML 1167
  174 IF (MAXHPI.EQ.0) GO TO 177                                         ML 1168
C***  DO NOT ALLOW AP(I)'S TO BE EQUAL TO ZERO                          ML 1169
         DO 175 I=1,13                                                   ML 1170
  175 IF (DABS(AP(I)).LT.1.0D-16)AP(I)=1.0D-10                           ML 1171
         DO 176 I=1,MAXHPI                                               ML 1172
         NHPI(I)=IUPATH(I)                                               ML 1173
C***  DETERMINE POWER AND LIFT COEFFICIENTS FROM EQUATION OF MOTION     ML 1174
C***  NORMAL TO FLIGHT PATH OR ADJUST A PRIORI WEIGHTS                  ML 1175
         CALL GDEQN(K,NWB,I)                                             ML 1176
         CALL HPATH(K,CSFC,NWB,LPRG,FIT,TARE,HTARE,NHPI(I))              ML 1177
  176 CONTINUE                                                           ML 1178
C***  CALL MODEL EXTRACTION ROUTINE                                     ML 1179
  177 CALL MODEL(K,LPRG,FIT,NWB)                                         ML 1180
C***  DETERMINE CONFIDENCE MAGNITUDES FOR ANGLE OF ATTACK AND PITCH     ML 1181
C***  ANGLE                                                             ML 1182
  178 XALP=0.0D0                                                         ML 1183
         XTHE=0.0D0                                                      ML 1184
         DO 179 I=1,K                                                    ML 1185
         XALP=XALP+(DABS((ALPHA(I)-F6(I))/AMAX))**2                      ML 1186
  179 XTHE=XTHE+(DABS((THETA(I)-F2(I))/TMAX))**2                         ML 1187
         XALP=XALP/K                                                     ML 1188
         XTHE=XTHE/K                                                     ML 1189
         WRITE (JWRITE,180) XALP,XTHE                                    ML 1190
  180 FORMAT (1X,////,43X,'ANGLE-OF-ATTACK CONFIDENCE = ',D20.13,/,43X,'P ML 1191
     1ITCH ANGLE CONFIDENCE = ',D20.13,///)                              ML 1192
C***  CHECK FIT ERROR FOR POSSIBLE ANALYSIS TERMINATION                 ML 1193
         IF (FIT(LPRG).LE.FITOK) GO TO 181                               ML 1194
C***  PROCEED WITH NEXT PROGRAM LOOP (LPRG+1)                           ML 1195
         LPRG=LPRG+1                                                     ML 1196
C***  TEST FOR SPECIFIED LOOP MAXIMUM                                   ML 1197
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      IF (LPRG.GT.LPRGRX) GO TO 181                                     ML 1198
C***  RESET INSTRUCTION CODES FOR NEXT LOOP                             ML 1199
      ISPF=0                                                            ML 1200
      LPSS=0                                                            ML 1201
      IUP=0                                                             ML 1202
      ISW=0                                                             ML 1203
      IPATH=0                                                           ML 1204
C***  TRANSFER TO CONTROL POINT                                         ML 1205
      GO TO 25                                                          ML 1206
C***  WRITE FINAL RESULTS                                               ML 1207
  181 WRITE (JWRITE,182) EX1,EX2,EX3,EX4,IEX1,IEX2,IEX3,IEX4,EXPX       ML 1208
  182 FORMAT (1X,////,16X,10G('*'),/,16X,'*',98('**'),'*',/,16X,'*',96X,' ML 1209
     1*',/,16X,'*',2X,'****FINAL***',4X,'GENERAL EXPRESSIONS FOR POWER  ML 1210
     1, DRAG COEFFICIENT, AND LIFT COEFFICIENT',9X,'*',/,16X,'*',96X,' ML 1211
     1*',/,16X,'*',96X,'*',/,16X,'*',3X,'P = P0 + P1*V**',1PD12.5,'     ML 1212
     1+ P2*V**',1PD12.5,' + P3*V**',1PD12.5,' + P4*V**',1PD12.5,3X,'*',  ML 1213
     1/,16X,'*',96X,'*',/,16X,'*',20X,'CD = CD0 + CD1*A**',I2,' + CD2    ML 1214
     1*A**',I2,' + CD3*A**',I2,' + CD4*A**',I2,20X,'*',/,16X,'*',96X,'   ML 1215
     1*',/,16X,'*',24X,'CL = CLA0 + CLA*A + CLA2*A**',1PD12.5,' + CL0*   ML 1216
     1A',24X,'*',/,16X,'*',96X,'*',/,16X,'*',96X,'*',/,16X,'*',3X,      ML 1217
     1'WHERE:',87X,'*',/,16X,'*',96X,'*')                               ML 1218
      IF (METRIC.NE.0) GO TO 183                                        ML 1219
      WRITE (JWRITE,143)                                                ML 1220
      GO TO 184                                                         ML 1221
  183 WRITE (JWRITE,145)                                                ML 1222
      GO TO 185                                                         ML 1223
  184 WRITE (JWRITE,147) CFM(1),CFM(6),CFM(11),CFM(2),CFM(7),CFM(12),CFM ML 1224
     1(3),CFM(8),CFM(13),CFM(4),CFM(9),CFM(14),CFM(5),CFM(10)           ML 1225
      GO TO 186                                                         ML 1226
  185 P0=CFM(1)*1.355818D-3                                             ML 1227
      P1=CFM(2)*1.355818D-3                                             ML 1228
      P2=CFM(3)*1.355818D-3                                             ML 1229
      P3=CFM(4)*1.355818D-3                                             ML 1230
      P4=CFM(5)*1.355818D-3                                             ML 1231
      WRITE (JWRITE,147) P0,CFM(6),CFM(11),P1,CFM(7),CFM(12),P2,CFM(8),C ML 1232
     1FM(13),P3,CFM(9),CFM(14),P4,CFM(10)                               ML 1233
C***  SET CODE FOR UPDATE ON POWER, AND DRAG AND LIFT COEFFICIENT       ML 1234
  186 ITERM=1                                                           ML 1235
      GO TO 50                                                          ML 1236
C***  WRITE RESULTS                                                     ML 1237
  187 WRITE (JWRITE,188)                                                ML 1238
  188 FORMAT (1X,////,9X,113('*'))                                      ML 1239
      DO 197 I=1,K                                                      ML 1240
      IF (METRIC.NE.0) GO TO 190                                        ML 1241
      WRITE (JWRITE,189) F1(I),F10(I),F2(I),F11(I),F3(I),F12(I),F4(I),F1 ML 1242
     13(I),I,F5(I),F14(I),F6(I),CL(I),F7(I),CD(I),F8(I),PWRA(I),F9(I),FT ML 1243
     11(I)                                                              ML 1244
  189 FORMAT (9X,'*',13X,'|',47X,'|',49X,'*',/,9X,'*',13X,'|',1X,'WEIGHT ML 1245
     1',14X,'= ',D12.5,' LBF    ',4X,'| ALTITUDE',14X,'= ',D12.5,' FT',9 ML 1246
     1X,'*',/,9X,'*',13X,'|',1X,'PITCH ANGLE',9X,'= ',D12.5,' RADIAN',5X ML 1247
     1,'| ALTITUDE RATE',9X,'= ',D12.5,' FT/SEC',5X,'*',/,9X,'*',13X,'|   ML 1248
     1PITCH RATE',10X,'= ',D12.5,' RADIAN/SEC | ALTITUDE-RATE RATE',4X,' ML 1249
     1= ',D12.5,' FT/SEC**2',2X,'*',/,9X,'*',13X,'| AIRSPEED',12X,'= ',D ML 1250
     112.5,' FT/SEC',5X,'| VERTICAL ACCELERATION = ',D12.5,' FT/SEC**2', ML 1251
     12X,'*',/,9X,'* DATA PT ',I3,' | DENSITY',13X,'= ',D12.5,' SLUG/FT* ML 1252
     1*3 | ELEVATOR DEFLECTION',3X,'= ',D12.5,' RADIAN',5X,'*',/,9X,'*', ML 1253
     113X,'| ANGLE OF ATTACK',5X,'= ',D12.5,' RADIAN',5X,'| LIFT COEFFIC ML 1254
     1IENT( CL )= ',D12.5,12X,'*',/,9X,'*',13X,'| TEMPERATURE',9X,'= ',D ML 1255
     112.5,' DEGREES-R  | DRAG COEFFICIENT( CD )= ',D12.5,12X,'*',/,9X,' ML 1256
     1*',13X,'| ACCELERATION',8X,'= ',D12.5,' FT/SEC**2  | POWER AVAILAB ML 1257
     1LE',7X,'= ',D12.5,' FT-LBF/SEC *',/,9X,'*',13X,'| ANGLE-OF-ATTACK  ML 1258
     1RATE= ',D12.5,' RADIAN/SEC | FLIGHT PATH ANGLE',5X,'= ',D12.5,' RA ML 1259
     1DIAN',5X,'*',/,9X,'*',13X,'|',47X,'|',49X,'*',/,9X,113('*'))      ML 1260
      GO TO 192                                                         ML 1261
  190 W=F1(I)*4.4482D0                                                  ML 1262
      ALT=F10(I)*0.3048D0                                               ML 1263
      ALTR=F11(I)*0.3048D0                                              ML 1264
      ALT2R=F12(I)*0.3048D0                                             ML 1265
      V=F4(I)*0.3048D0                                                  ML 1266
      AZ=F13(I)*0.3048D0                                                ML 1267
      RMR=F5(I)*32.16D0*16.02D0                                         ML 1268
      T=5.0D0/9.0D0*(F7(I)-491.72D0)+273.18D0                           ML 1269
      DV=F8(I)*0.3048D0                                                 ML 1270
      P=PHRA(I)*1.3558D0/1000.0D0                                       ML 1271
      WRITE (JWRITE,191) W,ALT,F2(I),ALTR,F3(I),ALT2R,V,AZ,I,RMR,F14(I), ML 1272
     1F6(I),CL(I),T,CD(I),DV,P,F9(I),FT(I)                              ML 1273
  191 FORMAT (9X,'*',13X,'|',47X,'|',49X,'*',/,9X,'*',13X,'|',1X,'WEIGHT ML 1274
     1',14X,'= ',D12.5,' NEWTONS',4X,'| ALTITUDE',14X,'= ',D12.5,' M ',9 ML 1275
     1X,'*',/,9X,'*',13X,'|',1X,'PITCH ANGLE',9X,'= ',D12.5,' RADIAN',5X ML 1276
     1,'| ALTITUDE RATE',9X,'= ',D12.5,' M/SEC ',5X,'*',/,9X,'*',13X,'|   ML 1277
     1PITCH RATE',10X,'= ',D12.5,' RADIAN/SEC | ALTITUDE-RATE RATE',4X,' ML 1278
     1= ',D12.5,' M/SEC**2 ',2X,'*',/,9X,'*',13X,'| AIRSPEED',12X,'= ',D ML 1279
     112.5,' M/SEC ',5X,'| VERTICAL ACCELERATION = ',D12.5,' M/SEC**2 ', ML 1280
     12X,'*',/,9X,'* DATA PT ',I3,' | DENSITY',13X,'= ',D12.5,' KG/M**3 ML 1281
     1   | ELEVATOR DEFLECTION',3X,'= ',D12.5,' RADIAN',5X,'*',/,9X,'*', ML 1282
     113X,'| ANGLE OF ATTACK',5X,'= ',D12.5,' RADIAN',5X,'| LIFT COEFFIC ML 1283
     1IENT( CL )= ',D12.5,12X,'*',/,9X,'*',13X,'| TEMPERATURE',9X,'= ',D ML 1284
     112.5,' DEGREES-K  | DRAG COEFFICIENT( CD )= ',D12.5,12X,'*',/,9X,' ML 1285
     1*',13X,'| ACCELERATION',8X,'= ',D12.5,' M/SEC**2  | POWER AVAILAB ML 1286
     1LE',7X,'= ',D12.5,' KILOWATTS  *',/,9X,'*',13X,'| ANGLE-OF-ATTACK  ML 1287
     1RATE= ',D12.5,' RADIAN/SEC | FLIGHT PATH ANGLE',5X,'= ',D12.5,' RA ML 1288
     1DIAN',5X,'*',/,9X,'*',13X,'|',47X,'|',49X,'*',/,9X,113('*'))      ML 1289
C***  PUNCH CARDS                                                       ML 1290
  192 IF (IPUNCH.EQ.0) GO TO 197                                        ML 1291
      IF (I.NE.1) GO TO 195                                             ML 1292
      WRITE (JPUNCH,193) (TITLE(J),J=1,20)                              ML 1293
  193 FORMAT (20A4)                                                     ML 1294
      WRITE (JPUNCH,194) M,S,WHO,TT,EX1,EX2,EX3,EX4,IEX1,IEX2,IEX3,IEX4, ML 1295
     1(CFM(J),J=1,14)                                                   ML 1296
  194 FORMAT (I5,5X,D18.11,2X,D18.11,2X,D18.11,/,4(D18.11,2X),/,4(I1,1X) ML 1297
     1,2X,3(D18.11,2X),/,4(D18.11,2X),/,4(D18.11,2X),/,3(D18.11,2X))    ML 1298
  195 WRITE (JPUNCH,196) TIME(I),F1(I),F2(I),F3(I),F4(I),F5(I),F6(I),F7( ML 1299
     1I),F8(I),F9(I),F10(I),F11(I),F12(I),F13(I),F14(I),CL(I),CD(I),PWRA ML 1300
     1(I)                                                               ML 1301
  196 FORMAT (D18.11,2X,D18.11,2X,D18.11,2X,D18.11)                     ML 1302
  197 CONTINUE                                                          ML 1303
C***  CHECK FOR PLOTS                                                   ML 1304
      IF (IPLOT.NE.0) GO TO 199                                         ML 1305
      JPLOT=1                                                           ML 1306
C***  DEFINE PLOT CODES                                                 ML 1307
C***  WARNING-- WARNING-- THE FOLLOWING PLOTTING ROUTINES MAY NOT BE    ML 1308
C***  COMPATIBLE FOR OTHER INSTALLATIONS.  THE USER SHOULD INQUIRE AT   ML 1309
C***  HIS INSTALLATION'S PROGRAMMING SERVICES.                          ML 1310
C***  COMPUTE TIME SPACING FOR PLOTTING                                 ML 1311
      TORG=TIME(K)                                                      ML 1312
      DO 198 I=2,21                                                     ML 1313
      IF (TORG.GT.TRG(I-1).AND.TORG.LE.TRG(I))TPTX=TRG(I)               ML 1314
      IF (TORG.EQ.TRG(I-1))TPTX=TRG(I-1)                                ML 1315
  198 CONTINUE                                                          ML 1316
      CALL PLOTIT(K,TPTX,IP)                                            ML 1317
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C***  CHECK FOR NEW DATA SET                                          NL 1318
  199 GO TO 1                                                         NL 1319
C***  TERMINATE PLOT ROUTINES AND PROGRAM                             NL 1320
  200 IF (JPLOT.NE.0) CALL PICSIZ(0.0,0.0)                            NL 1321
      STOP                                                            NL 1322
      END                                                             NL 1323



      SUBROUTINE PLOTIT(K,TPTX,IP)                                    PL    1
C                                                                     PL    2
C***  SUBROUTINE PLOTIT PLOTS TIME HISTORIES, CL VS ALPHA, CD VS ALPHA, PL    3
C***  CL VS CD, AND POWER VS AIRSPEED                                 PL    4
C                                                                     PL    5
      IMPLICIT REAL*8(A-H,O-Z)                                        PL    6
      DIMENSION KD(5),DUB(450),IP(18)                                 PL    7
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F PL    8
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 PL    9
     1),C(450,11),K(450,1),WKAR(250),CFM(14),SGM(4),SGD(4),FT1(450),FT2( PL   10
     1450),PWRA(450),CL(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S PL   11
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX PL   12
     12,IEX3,IEX4,METRIC,L1,L2,IEQNM(18),IERR                         PL   13
      COMMON /LAB2/YCEPT,ICD,MTH,MCLCC                                PL   14
      REAL*4 XRD(2,450),XD(2,450),YRD(2,450),YD(2,450),TPTP           PL   15
C                                                                     PL   16
      TPTP=TPTX                                                       PL   17
      DO 1 I=1,K                                                      PL   18
      IF (I.LE.5)KD(I)=-1                                             PL   19
    1 XRD(1,I)=TIME(I)                                                PL   20
C***  PLOT WEIGHT TIME HISTORY                                        PL   21
      IF (IP(1).NE.0) GO TO 4                                         PL   22
      DO 2 I=1,K                                                      PL   23
      YRD(1,I)=F1(I)                                                  PL   24
    2 IF (METRIC.NE.0)YRD(1,I)=YRD(1,I)*4.448200/100.0D0             PL   25
      CALL PICSIZ(10.0,10.0)                                          PL   26
      IF (METRIC.NE.0) GO TO 3                                        PL   27
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,3500.0,4500 PL   28
     1.0,250.0,1,'WEIGHT(LBF)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _')  PL   29
      GO TO 4                                                         PL   30
    3 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,150.0,200.0 PL   31
     1,5.0,1,'WEIGHT(NEWTONS)/100_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _' PL   32
     1)                                                               PL   33
C***  PLOT PITCH ANGLE TIME HISTORY                                   PL   34
    4 IF (IP(2).NE.0) GO TO 6                                         PL   35
      DO 5 I=1,K                                                      PL   36
    5 YRD(1,I)=F2(I)*100.0D0                                          PL   37
      CALL PICSIZ(10.0,10.0)                                          PL   38
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-80.0,80.0, PL   39
     110.0,1,'PITCH ANGLE(RADIAN) X 100_',YRD,YD,1,2,1,450,K,0,0,0,0,KD, PL   40
     11,' _')                                                         PL   41
C***  PLOT PITCH RATE TIME HISTORY                                    PL   42
    6 IF (IP(3).NE.0) GO TO 8                                         PL   43
      DO 7 I=1,K                                                      PL   44
    7 YRD(1,I)=F3(I)*100.0D0                                          PL   45
      CALL PICSIZ(10.0,10.0)                                          PL   46
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-80.0,80.0, PL   47
     110.0,1,'PITCH RATE(RAD/SEC) X 100_',YRD,YD,1,2,1,450,K,0,0,0,0,KD, PL   48
     11,' _')                                                         PL   49
C***  PLOT AIRSPEED TIME HISTORY                                      PL   50
    8 IF (IP(4).NE.0) GO TO 11                                        PL   51
      DO 9 I=1,K                                                      PL   52
      YRD(1,I)=F4(I)                                                  PL   53
    9 IF (METRIC.NE.0)YRD(1,I)=YRD(1,I)*0.3048D0                      PL   54
      CALL PICSIZ(10.0,10.0)                                          PL   55
      IF (METRIC.NE.0) GO TO 10                                       PL   56
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,80.0,300.0, PL   57
     120.0,1,'AIRSPEED(FT/SEC)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _') PL   58
      GO TO 11                                                        PL   59
   10 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,25.0,100.0, PL   60
     15.0,1,'AIRSPEED(M/SEC)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _')  PL   61
C***  PLOT DENSITY TIME HISTORY                                       PL   62
   11 IF (IP(5).NE.0) GO TO 14                                        PL   63
      DO 12 I=1,K                                                     PL   64
      YRD(1,I)=F5(I)*10000.0D0                                        PL   65
   12 IF (METRIC.NE.0)YRD(1,I)=F5(I)*5153.8D0                         PL   66
      CALL PICSIZ(10.0,10.0)                                          PL   67
      IF (METRIC.NE.0) GO TO 13                                       PL   68
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,14.0,26.0,2 PL   69
     1.0,1,'DENSITY(SLUG/FT**3) X 10000_',YRD,YD,1,2,1,450,K,0,0,0,0,KD, PL   70
     11,' _')                                                         PL   71
      GO TO 14                                                        PL   72
   13 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,6.0,12.0,1. PL   73
     10,1,'DENSITY(KG/M**3) X 10_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _') PL   74
C***  PLOT ANGLE OF ATTACK TIME HISTORY                               PL   75
   14 IF (IP(6).NE.0) GO TO 16                                        PL   76
      DO 15 I=1,K                                                     PL   77
   15 YRD(1,I)=F6(I)*100.0D0                                          PL   78
      CALL PICSIZ(10.0,10.0)                                          PL   79
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-5.0,40.0,5 PL   80
     1.0,1,'ANGLE OF ATTACK(RAD) X 100_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1 PL   81
     1,' _')                                                          PL   82
C***  PLOT TEMPERATURE TIME HISTORY                                   PL   83
   16 IF (IP(7).NE.0) GO TO 19                                        PL   84
      DO 17 I=1,K                                                     PL   85
      YRD(1,I)=F7(I)                                                  PL   86
   17 IF (METRIC.NE.0)YRD(1,I)=5.0D0/9.0D0*(F7(I)-491.72D0)+273.18D0  PL   87
      CALL PICSIZ(10.0,10.0)                                          PL   88
      IF (METRIC.NE.0) GO TO 18                                       PL   89
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,450.0,550.0 PL   90
     1,25.0,1,'TEMPERATURE(DEG-R)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _' PL   91
     1)                                                               PL   92
      GO TO 19                                                        PL   93
   18 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,250.0,300.0 PL   94
     1,10.0,1,'TEMPERATURE(DEG-K)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _' PL   95
     1)                                                               PL   96
C***  PLOT ACCELERATION TIME HISTORY                                  PL   97
   19 IF (IP(8).NE.0) GO TO 22                                        PL   98
      DO 20 I=1,K                                                     PL   99
      YRD(1,I)=F8(I)                                                  PL  100
   20 IF (METRIC.NE.0)YRD(1,I)=F8(I)*0.3048D0                         PL  101
      CALL PICSIZ(10.0,10.0)                                          PL  102
      IF (METRIC.NE.0) GO TO 21                                       PL  103
      CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-32.0,32.0, PL  104
     14.0,1,'ACCELERATION(FT/SEC**2)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' PL  105
     1 _')                                                            PL  106
      GO TO 22                                                        PL  107
   21 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0, PL  108
     11.0,1,'ACCELERATION(M/SEC**2)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' PL  109
     1_')                                                             PL  110
C***  PLOT ANGLE-OF-ATTACK RATE TIME HISTORY                          PL  111
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      22 IF (IP(9).NE.0) GO TO 24                                       PL  112
         DO 23 I=1,K                                                    PL  113
      23 YRD(1,I)=F9(I)*100.0D0                                         PL  114
         CALL PICSIZ(10.0,19.0)                                         PL  115
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0,  PL  116
        11.0,1,'ANGLE-OF-ATTACK RATE(RAD/SEC) X 100_',YRD,YD,1,2,1,450,K,0.  PL  117
        10,0,0,KD,1,' _')                                               PL  118
      GO TO 27                                                          PL  119
C***  PLOT ALTITUDE TIME HISTORY                                        PL  120
      24 IF (IP(10).NE.0) GO TO 27                                      PL  121
         DO 25 I=1,K                                                    PL  122
         YRD(1,I)=F10(I)/1000.0D0                                       PL  123
      25 IF (METRIC.NE.0) YRD(1,I)=F10(I)/100.0D0*0.3048D0              PL  124
         CALL PICSIZ(10.0,10.0)                                         PL  125
         IF (METRIC.NE.0) GO TO 26                                      PL  126
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,2.0,16.0,1.  PL  127
        10,1,'ALTITUDE(FT)/1000_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _')  PL  128
         GO TO 27                                                       PL  129
      26 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,0.0,48.0,2.  PL  130
        10,1,'ALTITUDE(M)/100 _',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _')  PL  131
C***  PLOT ALTITUDE RATE TIME HISTORY                                   PL  132
      27 IF (IP(11).NE.0) GO TO 30                                      PL  133
         DO 28 I=1,K                                                    PL  134
         YRD(1,I)=F11(I)                                                PL  135
      28 IF (METRIC.NE.0) YRD(1,I)=F11(I)*0.3048D0                      PL  136
         CALL PICSIZ(10.0,10.0)                                         PL  137
         IF (METRIC.NE.0) GO TO 29                                      PL  138
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-100.0,100.  PL  139
        10,10.0,1,'ALTITUDE RATE(FT/SEC)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1.  PL  140
        1' _')                                                          PL  141
         GO TO 30                                                       PL  142
      29 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-34.0,34.0,  PL  143
        14.0,1,'ALTITUDE RATE(M/SEC)_',YRD,YD,1,2,1,450,K,0,0,0,0,KD,1,' _'  PL  144
        1)                                                              PL  145
C***  PLOT ALTITUDE ACCELERATION TIME HISTORY                           PL  146
      30 IF (IP(12).NE.0) GO TO 33                                      PL  147
         DO 31 I=1,K                                                    PL  148
         YRD(1,I)=F12(I)                                                PL  149
      31 IF (METRIC.NE.0) YRD(1,I)=F12(I)*0.3048D0                      PL  150
         CALL PICSIZ(10.0,10.0)                                         PL  151
         IF (METRIC.NE.0) GO TO 32                                      PL  152
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-100.0,100.  PL  153
        10,10.0,1,'ALTITUDE ACCELERATION(FT/SEC**2)_',YRD,YD,1,2,1,450,K,0.  PL  154
        10,0,0,KD,1,' _')                                               PL  155
         GO TO 33                                                       PL  156
      32 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-34.0,34.0,  PL  157
        14.0,1,'ALTITUDE ACCELERATION(M/SEC**2)_',YRD,YD,1,2,1,450,K,0,0,0,  PL  158
        10,KD,1,' _')                                                   PL  159
C***  PLOT VERTICAL ACCELERATION TIME HISTORY                           PL  160
      33 IF (IP(13).NE.0) GO TO 36                                      PL  161
         DO 34 I=1,K                                                    PL  162
         YRD(1,I)=F13(I)                                                PL  163
      34 IF (METRIC.NE.0) YRD(1,I)=F13(I)*0.3048D0                      PL  164
         CALL PICSIZ(10.0,10.0)                                         PL  165
         IF (METRIC.NE.0) GO TO 35                                      PL  166
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-32.0,32.0,  PL  167
        14.0,1,'VERTICAL ACCELERATION(FT/SEC**2)_',YRD,YD,1,2,1,450,K,0,0,0  PL  168
        1,0,KD,1,' _')                                                  PL  169
         GO TO 36                                                       PL  170
      35 CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-10.0,10.0,  PL  171
        12.0,1,'VERTICAL ACCELERATION(M/SEC**2)_',YRD,YD,1,2,1,450,K,0,0,0,  PL  172
        10,KD,1,' _')                                                   PL  173
C***  PLOT ELEVATOR DEFLECTION TIME HISTORY                             PL  174
      36 IF (IP(14).NE.0) GO TO 38                                      PL  175
         DO 37 I=1,K                                                    PL  176
      37 YRD(1,I)=F14(I)*100.0D0                                        PL  177
         CALL PICSIZ(10.0,10.0)                                         PL  178
         CALL GRAFF(8.0,0.0,TPTP,5.0,1,'TIME(SECS)_',XRD,XD,5.5,-25.0,25.0,  PL  179
        15.0,1,'ELEVATOR DEFLECTION(RAD) X 100_',YRD,YD,1,2,1,450,K,0,0,0,0  PL  180
        1,KD,1,' _')                                                    PL  181
C***  PLOT LIFT COEFFICIENT VS ANGLE OF ATTACK                          PL  182
      38 IF (IP(15).NE.0) GO TO 44                                      PL  183
         KD(2)=0                                                        PL  184
         CALL ASCEN(K,CL,F6,X1,X2)                                      PL  185
         DO 42 I=1,K                                                    PL  186
         XRD(1,I)=X2(I)*100.0D0                                         PL  187
         YRD(1,I)=X1(I)*10.0D0                                          PL  188
         XRD(2,I)=XRD(1,I)                                              PL  189
         GO TO (39,40,41),ICD                                           PL  190
      39 IF (F6(I).GT.0.0D0) GO TO 40                                   PL  191
         DUM(I)=CFN(12)*F6(I)+YCEPT+CFN(14)*F3(I)                       PL  192
         GO TO 42                                                       PL  193
      40 DUM(I)=CFN(11)+CFN(12)*F6(I)+CFN(13)*F6(I)**EXPX+CFN(14)*F3(I) PL  194
         GO TO 42                                                       PL  195
      41 DUM(I)=CFN(11)+CFN(12)*F6(I)+CFN(13)*F6(I)**2+CFN(14)*F3(I)    PL  196
      42 CONTINUE                                                       PL  197
         CALL ASCEN(K,DUM,F6,X1,X2)                                     PL  198
         DO 43 I=1,K                                                    PL  199
      43 YRD(2,I)=X1(I)*10.0D0                                          PL  200
         CALL PICSIZ(10.0,10.0)                                         PL  201
         CALL GRAFF(8.0,-5.0,80.0,5.0,1,'ANGLE OF ATTACK(RAD) X 100_',XRD,X  PL  202
        1D,5.5,0.0,20.0,2.0,1,'LIFT COEFFICIENT X 10_',YRD,YD,1,2,2,450,K,K  PL  203
        1,0,0,0,KD,1,' _')                                              PL  204
C***  PLOT DRAG COEFFICIENT VS ANGLE OF ATTACK                          PL  205
      44 IF (IP(16).NE.0) GO TO 46                                      PL  206
         CALL ASCEN(K,CD,F6,X1,X2)                                      PL  207
         DO 45 I=1,K                                                    PL  208
         XRD(1,I)=X2(I)*100.0D0                                         PL  209
      45 YRD(1,I)=X1(I)*100.0D0                                         PL  210
         CALL PICSIZ(10.0,10.0)                                         PL  211
         CALL GRAFF(8.0,-5.0,40.0,5.0,1,'ANGLE OF ATTACK(RAD) X 100_',XRD,X  PL  212
        10,5.5,0.0,15.0,1.0,1,'DRAG COEFFICIENT X 100_',YRD,YD,1,2,1,450,K,  PL  213
        10,0,0,0,KD,1,' _')                                             PL  214
C***  PLOT LIFT COEFFICIENT VS DRAG COEFFICIENT                         PL  215
      46 IF ((IP(17).NE.0.OR.IP(15).NE.0).OR.IP(16).NE.0) GO TO 49      PL  216
         CALL ASCEN(K,CL,CD,X1,X2)                                      PL  217
         DO 47 I=1,K                                                    PL  218
         XRD(1,I)=X2(I)*100.0D0                                         PL  219
         XRD(2,I)=XRD(1,I)                                              PL  220
      47 YRD(1,I)=X1(I)*100.0D0                                         PL  221
         CALL ASCEN(K,DUM,CD,X1,X2)                                     PL  222
         DO 48 I=1,K                                                    PL  223
      48 YRD(2,I)=X1(I)*100.0D0                                         PL  224
         CALL PICSIZ(10.0,10.0)                                         PL  225
         CALL GRAFF(8.0,0.0,15.0,1.0,1,'DRAG COEFFICIENT (CD) X 100_',XRD,X  PL  226
        1D,5.5,0.0,200.0,20.0,1,'LIFT COEFFICIENT (CL) X 100_',YRD,YD,1,2,2  PL  227
        1,450,K,K,0,0,0,KD,1,' _')                                      PL  228
C***  PLOT POWER AVAILABLE VS AIRSPEED                                  PL  229
      49 IF (IP(18).NE.0) GO TO 52                                      PL  230
         CALL ASCEN(K,PWRA,F4,X1,X2)                                    PL  231
         DO 50 I=1,K
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      XRD(1,I)=X2(I)                                                    PL  232
      YRD(1,I)=X1(I)/1000.0D0                                           PL  233
      IF (METRIC.EQ.0) GO TO 50                                         PL  234
      XRD(1,I)=XRD(1,I)*0.3048D0                                        PL  235
      YRD(1,I)=X1(I)*1.3558D0/1000.0                                    PL  236
   50 CONTINUE                                                          PL  237
      CALL PICSIZ(10.0,10.0)                                            PL  238
      IF (METRIC.NE.0) GO TO 51                                         PL  239
      CALL GRAFF(8.0,80.0,300.0,20.0,1,'AIRSPEED(FT/SEC)_',XRD,XD,5.5,20 PL  240
     1.0,220.0,20.0,1,'POWER AVAILABLE(FT-LBF/SEC)/1000_',XRD,YD,1,2,1,4 PL  241
     150,K,0,0,0.0,XD,1,' _')                                           PL  242
      GO TO 52                                                          PL  243
   51 CALL GRAFF(8.0,25.0,100.0,5.0,1,'AIRSPEED(M/SEC)_',XRD,XD,5.5,30.0 PL  244
     1,300.0,10.0,1,'POWER AVAILABLE(KILOWATTS)_',YRD,YD,1,2,1,450,K,0,0 PL  245
     1,0,0,XD,1,' _')                                                   PL  246
   52 RETURN                                                            PL  247
      END                                                               PL  248


      SUBROUTINE ABIAS(K,LPRG,FIT,NNB)                                  AB    1
C                                                                       AB    2
C***  SUBROUTINE ABIAS CALCULATES A CONSTANT BIAS IN ANGLE OF ATTACK    AB    3
C                                                                       AB    4
      IMPLICIT REAL*8(A-H,O-Z)                                          AB    5
      DIMENSION FIT(2),ST(10)                                           AB    6
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F AB    7
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 AB    8
     1),C(450,11),X(450,1),WKAR(250),CFM(14),SGN(4),SGD(4),FT1(450),FT2( AB    9
     1450),PWRA(450),CL(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S AB   10
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX AB   11
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                           AB   12
C                                                                       AB   13
C***  INITIALIZE PARAMETERS                                             AB   14
      IT=0                                                              AB   15
      BF=0.6667D0                                                       AB   16
C***  STORE PERTINENT INFORMATION                                       AB   17
    1 SN1=FIT(LPRG)                                                     AB   18
      DO 2 I=1,10                                                       AB   19
    2 ST(I)=CFM(I)                                                      AB   20
C***  STEP AND CHECK COUNTER                                            AB   21
      IT=IT+1                                                           AB   22
      IF (IT.GE.2) GO TO 12                                             AB   23
C***  SET LOOP PARAMETERS                                               AB   24
      CALL CHNGE(SGN)                                                   AB   25
      CALL CHNGE(SGD)                                                   AB   26
      IX1=IEX1-1                                                        AB   27
      IX2=IEX2-1                                                        AB   28
      IX3=IEX3-1                                                        AB   29
      IX4=IEX4-1                                                        AB   30
      BB=0.0D0                                                          AB   31
      BBB=0.0D0                                                         AB   32
C***  CALCULATE THE BIAS SUMS                                           AB   33
      DO 4 I=1,K                                                        AB   34
      W=F1(I)                                                           AB   35
      T=F2(I)                                                           AB   36
      V=F4(I)                                                           AB   37
      R=F5(I)                                                           AB   38
      A=F6(I)                                                           AB   39
      AM=DABS(A)                                                        AB   40
      IF (A.GE.0.0D0) GO TO 3                                           AB   41
      CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)                               AB   42
      CALL SIGNS(SGD,IX1,IX2,IX3,IX4)                                   AB   43
    3 P=CFM(1)*CFM(2)*V**EX1*CFM(3)*V**EX2*CFM(4)*V**EX3*CFM(5)*V**EX4  AB   44
      CD=CFM(6)+CFM(7)*SGN(1)*AM**IEX1*CFM(8)*SGN(2)*AM**IEX2*CFM(9)*SGN AB   45
     1(3)*AM**IEX3*CFM(10)*SGN(4)*AM**IEX4                              AB   46
      B0=G*DSIN(A*TIA)/(M*V)*P*G*S*R*V*V/(2.0D0*M)*(SGD(1)*IEX1*AM**IX1* AB   47
     1CFM(7)+SGD(2)*IEX2*AM**IX2*CFM(8)+SGD(3)*IEX3*AM**IX3*CFM(9)*SGD(4 AB   48
     1)*IEX4*AM**IX4*CFM(10))                                           AB   49
      B1=F8(I)-G*DCOS(A*TIA)/(M*V)*P*G*S*R*V*V/(2.0D0*M)*CD*G*DSIN(T-A)  AB   50
      BB=BB+BG*B1                                                       AB   51
      BBB=BBB+B0*B0                                                     AB   52
      IF (A.GE.0.0D0) GO TO 4                                           AB   53
      CALL CHNGE(SGN)                                                   AB   54
      CALL CHNGE(SGD)                                                   AB   55
    4 CONTINUE                                                          AB   56
C***  CALCULATE THE BIAS                                                AB   57
      ABS=-BB/BBB                                                       AB   58
      WRITE (JWRITE,5) ABS                                              AB   59
    5 FORMAT (1X,/,30X,70('-'),/,30X,'|',68X,'|',/,30X,'|',3X,'6HCALCULA AB   60
     1TED CONSTANT BIAS IN ANGLE OF ATTACK = ',1PD16.9,3X,'|')          AB   61
      IF (DABS(ABS).LT.5.0D-07) GO TO 7                                 AB   62
      WRITE (JWRITE,6)                                                  AB   63
    6 FORMAT (30X,'|',68X,'|',/,30X,70('-'))                            AB   64
      GO TO 9                                                           AB   65
    7 WRITE (JWRITE,8)                                                  AB   66
    8 FORMAT (3GX,'|',3X,'ANGLE-OF-ATTACK BIAS < 5.0D-07.  BYPASSING ANA AB   67
     1LYSIS.',13X,'|',/,30X,'|',68X,'|',/,30X,70('-'),///)              AB   68
      RETURN                                                            AB   69
C***  CORRECT ANGLE OF ATTACK                                           AB   70
    9 DO 10 I=1,K                                                       AB   71
   10 F6(I)=F6(I)+ABS*BF                                                AB   72
C***  PERFORM MODEL EXTRACTION                                          AB   73
      CALL MODEL(K,LPRG,FIT,NNB)                                        AB   74
      IF (IERR.NE.0) RETURN                                             AB   75
      SN2=FIT(LPRG)                                                     AB   76
C***  CHECK FIT ERROR                                                   AB   77
      IF (SN2.LT.SN1) GO TO 1                                           AB   78
      FIT(LPRG)=SN1                                                     AB   79
C***  READJUST ANGLE OF ATTACK                                          AB   80
      DO 11 I=1,K                                                       AB   81
   11 F6(I)=F6(I)-ABS*BF                                                AB   82
   12 DO 13 I=1,10                                                      AB   83
   13 CFM(I)=ST(I)                                                      AB   84
      RETURN                                                            AB   85
      END                                                               AB   86


      SUBROUTINE ALPDEL(K,LPRG,NNB,FIT)                                 AD    1
C                                                                       AD    2
C***  SUBROUTINE ALPDEL PERFORMS FREQUENCY-DEPENDENT CORRECTIONS TO THE  AD    3
C***  VALUES OF ANGLE OF ATTACK                                         AD    4
C                                                                       AD    5
      IMPLICIT REAL*8(A-H,O-Z)                                          AD    6
      DIMENSION FIT(2),ST(4,450),SA(4,450),FC(4,11),AL(4)               AD    7
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F AD    8
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 AD    9
     1),C(450,11),X(450,1),WKAR(250),CFM(14),SGN(4),SGD(4),FT1(450),FT2( AD   10
     1450),PWRA(450),CL(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S AD   11
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      1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX AD  12
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(10),IERR                            AD  13
      COMMON /LAB2/YCEPT,ICD,MTH,MCLCC                                   AD  14
      INTEGER NLLS(6)/2,3,3,4,2,3/,NLSD(6)/2,2,4,4,3,3/                  AD  15
C                                                                        AD  16
C***  INITIALIZE PARAMETERS                                              AD  17
      BS3=0.3D0                                                          AD  18
      IUP=0                                                              AD  19
      IT=0                                                               AD  20
      WRITE (JWRITE,1)                                                   AD  21
    1 FORMAT (6X,120('*'),/,6X,6('*'),1X,46HBEGIN FREQUENCY CORRECTIONS  AD  22
     1TO ANGLE OF ATTACK,1X,6('*'))                                      AD  23
C***  STORE PERTINENT INFORMATION                                        AD  24
      DO 2 I=1,K                                                         AD  25
      ST(1,I)=F2(I)                                                      AD  26
    2 SA(1,I)=F6(I)                                                      AD  27
      DO 3 I=1,10                                                        AD  28
    3 FC(1,I)=CFN(I)                                                     AD  29
      FC(1,11)=FIT(LPRG)                                                 AD  30
C***  CHECK AND STEP COUNTER                                             AD  31
    4 IF (IT.GE.3) GO TO 59                                              AD  32
      IT=IT+1                                                            AD  33
      WRITE (JWRITE,5) IT                                                AD  34
    5 FORMAT (1X,//,6X,'ITERATION#',I2,/)                                AD  35
      IF (IT.GT.2)BS3=1.0D0                                              AD  36
C***  COMPUTE POWER AVAILABLE AND LIFT COEFFICIENT                       AD  37
    6 DO 7 I=1,K                                                         AD  38
      PWRA(I)=CFN(1)+CFN(2)*F4(I)**EX1+CFN(3)*F4(I)**EX2+CFN(4)*F4(I)**E AD  39
     1X3+CFN(5)*F4(I)**EX4                                               AD  40
    7 CL(I)=(2.0D0*F1(I)/(F5(I)*F4(I)*G*S))*(FT2(I)+G*DCOS(FT1(I)))/F4(I) AD  41
     1-G*PWRA(I)*DSIN(F6(I)+TIA)/(F1(I)*F4(I)**2))                       AD  42
C***  CHECK LIFT FUNCTION CODE FOR DETERMINATION OF NUMBER OF UNKNOWNS   AD  43
      M=NLLS(MTH+1)                                                      AD  44
      IF (MCLCC.NE.0)M=NLSD(MTH+1)                                       AD  45
      IF (MCLCC.EQ.0) GO TO 20                                           AD  46
C***  ADJUST CL'S, IF NECESSARY, FOR PITCH RATE DEPENDENCY               AD  47
      IF ((MTH.EQ.0.OR.MTH.EQ.2).OR.MTH.EQ.4) GO TO 10                   AD  48
      DO 9 I=1,K                                                         AD  49
    9 CL(I)=CL(I)-CFN(14)*F3(I)                                          AD  50
C***  ORDER DATA FOR DETERMINING LIFT COEFFICIENTS                       AD  51
   10 CALL ASCEN(K,CL,F6,X1,X2)                                          AD  52
C***  CHECK FOR NEGATIVE OR ZERO X2'S                                    AD  53
      JJ=0                                                               AD  54
      DO 11 I=1,K                                                        AD  55
      IF (X2(I).GT.0.0D0) GO TO 12                                       AD  56
   11 JJ=JJ+1                                                            AD  57
   12 KM=K-JJ                                                            AD  58
      IF (KM.EQ.K) GO TO 15                                              AD  59
C***  STORE VALUES FOR LATER COMPUTATION                                 AD  60
      DO 13 I=1,JJ                                                       AD  61
      WKAR(I)=X2(I)                                                      AD  62
   13 WKAR(I+JJ)=X1(I)                                                   AD  63
C***  ADJUST REMAINING POINTS FOR LEAST-SQUARE DISTANCE                  AD  64
      DO 14 I=1,KM                                                       AD  65
      X1(I)=X1(JJ+I)                                                     AD  66
   14 X2(I)=X2(JJ+I)                                                     AD  67
C***  INITIALIZE LEAST-SQUARE-DISTANCE COEFFICIENTS                      AD  68
   15 AL(1)=CFN(11)                                                      AD  69
      AL(2)=CFN(12)                                                      AD  70
      AL(3)=CFN(13)                                                      AD  71
      AL(4)=EXPX                                                         AD  72
      LH=0                                                               AD  73
C***  PERFORM LEAST-SQUARE-DISTANCE FIT                                  AD  74
      CALL LSD(K2,K1,KM,AL,M,RMS,LH,IERR,JWRITE,MTH)                     AD  75
      IF (LH.NE.0) GO TO 17                                              AD  76
      WRITE (JWRITE,16)                                                  AD  77
   16 FORMAT (1X,//,45X,42HLIFT COEFFICIENTS BY LEAST-SQUARE DISTANCE,/) AD  78
C***  DEFINE CODE AND LIFT COEFFICIENTS                                  AD  79
      ICD=1                                                              AD  80
      CFN(11)=AL(1)                                                      AD  81
      CFN(12)=AL(2)                                                      AD  82
      CFN(13)=AL(3)                                                      AD  83
      EXPX=AL(4)                                                         AD  84
C***  COMPUTE INTERCEPT                                                  AD  85
      IF (JJ.EQ.0) GO TO 47                                              AD  86
      YCEPT=WKAR(JJ+JJ)-CFN(12)*WKAR(JJ)                                 AD  87
      GO TO 47                                                           AD  88
C***  DEFAULT TO LINEAR LEAST-SQUARES FIT                                AD  89
   17 IF ((MTH.EQ.0.OR.MTH.EQ.2).OR.MTH.EQ.4) GO TO 19                   AD  90
      DO 18 I=1,K                                                        AD  91
   18 CL(I)=CL(I)+CFN(14)*F3(I)                                          AD  92
   19 M=NLLS(MTH+1)                                                      AD  93
C***  PERFORM LINEAR LEAST-SQUARES FIT                                   AD  94
   20 MTHP1=MTH+1                                                        AD  95
      DO 27 I=1,K                                                        AD  96
      IF (F6(I).LE.0.0.AND.MTH.GE.2) GO TO 28                            AD  97
      C(I,1)=1.0D0                                                       AD  98
      GO TO (21,22,23,24,25,26),MTHP1                                    AD  99
   21 C(I,2)=F6(I)                                                       AD 100
      GO TO 27                                                           AD 101
   22 C(I,2)=F6(I)                                                       AD 102
      C(I,3)=F3(I)                                                       AD 103
      GO TO 27                                                           AD 104
   23 C(I,2)=F6(I)                                                       AD 105
      C(I,3)=F6(I)**EXPX                                                 AD 106
      GO TO 27                                                           AD 107
   24 C(I,2)=F6(I)                                                       AD 108
      C(I,3)=F6(I)**EXPX                                                 AD 109
      C(I,4)=F3(I)                                                       AD 110
      GO TO 27                                                           AD 111
   25 C(I,2)=F6(I)**EXPX                                                 AD 112
      GO TO 27                                                           AD 113
   26 C(I,2)=F6(I)**EXPX                                                 AD 114
      C(I,3)=F3(I)                                                       AD 115
   27 X(I,1)=CL(I)                                                       AD 116
      ICD=2                                                              AD 117
      GO TO 36                                                           AD 118
   28 EXPX=2.0D0                                                         AD 119
      DO 35 I=1,K                                                        AD 120
      C(I,1)=1.0D0                                                       AD 121
      GO TO (29,30,31,32,33,34),MTHP1                                    AD 122
   29 C(I,2)=F6(I)                                                       AD 123
      GO TO 35                                                           AD 124
   30 C(I,2)=F6(I)                                                       AD 125
      C(I,3)=F3(I)                                                       AD 126
      GO TO 35                                                           AD 127
   31 C(I,2)=F6(I)                                                       AD 128
      C(I,3)=F6(I)*F6(I)                                                 AD 129
      GO TO 35                                                           AD 130
   32 C(I,2)=F6(I)                                                       AD 131
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      C(I,3)=F6(I)*F6(I)                                                AD  132
      C(I,4)=F3(I)                                                      AD  133
      GO TO 35                                                          AD  134
   33 C(I,2)=F6(I)*F6(I)                                                AD  135
      GO TO 35                                                          AD  136
   34 C(I,2)=F6(I)*F6(I)                                                AD  137
      C(I,3)=F3(I)                                                      AD  138
   35 X(I,1)=CL(I)                                                      AD  139
      ICD=3                                                             AD  140
   36 CALL LLSQAR(C,X,K,N,1,450,450,15,WKAR,IER,JWRITE)                 AD  141
      IF (IER.EQ.129) WRITE (JWRITE,37)                                 AD  142
   37 FORMAT (1X,//,10X,'ZERO MATRIX ENCOUNTERED.  LOCATION:ALPDEL.  TO AD  143
     1NEXT DATA SET, IF ANY.',//)                                       AD  144
      IF (IER.EQ.129)IERR=1                                             AD  145
      IF (IERR.NE.0) RETURN                                             AD  146
      CFM(11)=X(1,1)                                                    AD  147
      DO 38 I=12,14                                                     AD  148
   38 CFM(I)=0.0D0                                                      AD  149
      GO TO (39,40,41,42,43,44),MTHP1                                   AD  150
   39 CFM(12)=X(2,1)                                                    AD  151
      GO TO 45                                                          AD  152
   40 CFM(12)=X(2,1)                                                    AD  153
      CFM(13)=X(3,1)                                                    AD  154
      GO TO 45                                                          AD  155
   41 CFM(12)=X(2,1)                                                    AD  156
      CFM(13)=X(3,1)                                                    AD  157
      GO TO 45                                                          AD  158
   42 CFM(12)=X(2,1)                                                    AD  159
      CFM(13)=X(3,1)                                                    AD  160
      CFM(14)=X(4,1)                                                    AD  161
      GO TO 45                                                          AD  162
   43 CFM(13)=X(2,1)                                                    AD  163
      GO TO 45                                                          AD  164
   44 CFM(13)=X(2,1)                                                    AD  165
      CFM(14)=X(3,1)                                                    AD  166
   45 WRITE (JWRITE,46)                                                 AD  167
   46 FORMAT (1X,//,45X,41HLIFT COEFFICIENTS BY LINEAR LEAST SQUARES,/) AD  168
      LM=0                                                              AD  169
   47 WRITE (JWRITE,48) CFM(11),CFM(12),CFM(13),EXPX,CFM(14)            AD  170
   48 FORMAT (52X,7HCLA0 = ,D23.16,/,52X,7HCLA  = ,D23.16,/,52X,7HCLAX = AD  171
     1 ,D23.16,/,52X,7HEXPX = ,D23.16,/,52X,7HCLQ  = ,D23.16,//)        AD  172
C***  CHECK ON UPDATE CODE                                              AD  173
      IF (IUP.NE.0) WRITE (JWRITE,49)                                   AD  174
   49 FORMAT (6X,6('**'),1X,46H END  FREQUENCY CORRECTIONS TO ANGLE OF AT AD  175
     1TACK,1X,6('**'),/,6X,120('**'))                                   AD  176
      IF (IUP.NE.0) GO TO 64                                            AD  177
C***  INITIALIZE FIT ERROR SUM                                          AD  178
      TSX=0.0D0                                                         AD  179
C***  SOLVE FOR ANGLE OF ATTACK BY NEWTON-RAPHSON                       AD  180
      NCNT=0                                                            AD  181
      DO 54 I=1,K                                                       AD  182
      CALL NEWTON(1,A,NCNT)                                             AD  183
      ALP=A-F6(I)                                                       AD  184
C***  COMPUTE FREQUENCY-DEPENDENT ANGLE-OF-ATTACK CORRECTIONS           AD  185
      F6(I)=F6(I)+BSJ*ALP                                               AD  186
C***  COMPUTE FIT ERROR                                                 AD  187
      GO TO (50,51,52),ICD                                              AD  188
   50 IF (F6(I).GT.0.0D0) GO TO 51                                      AD  189
      CLX=CFM(12)*F6(I)+XCEPT*CFM(14)*F3(I)                             AD  190
      GO TO 53                                                          AD  191
   51 CLX=CFM(11)+CFM(12)*F6(I)+CFM(13)*F6(I)**EXPX+CFM(14)*F3(I)       AD  192
      GO TO 53                                                          AD  193
   52 CLX=CFM(11)+CFM(12)*F6(I)+CFM(13)*F6(I)*F6(I)+CFM(14)*F3(I)       AD  194
   53 SX=(FT2(I)-G*S*F5(I)*F4(I)*CLX/(2.0D0*PI(I))+G*DCOS(FT1(I))/F4(I)- AD  195
     1G*PHRA(I)*DSIN(F6(I)*TIA))/(F1(I)*F4(I)**2))                      AD  196
      TSX=TSX+SX*SX                                                     AD  197
   54 CONTINUE                                                          AD  198
      IF (NCNT.NE.0) WRITE (JWRITE,55) NCNT                             AD  199
   55 FORMAT (1X,//,9X,94H*** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK AD  200
     1IN NEWTON, ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)    AD  201
      WRITE (JWRITE,56) TSX                                             AD  202
   56 FORMAT (1X,//,30X,52HFREQUENCY-DEPENDENT FIT ERROR FOR ANGLE OF AT AD  203
     1TACK = ,D20.13,//)                                                AD  204
C***  COMPUTE PITCH ANGLE CORRECTION DUE TO CORRECTIONS IN ANGLE OF     AD  205
C***  ATTACK                                                            AD  206
      CALL GAMX(K)                                                      AD  207
C***  PERFORM MODEL EXTRACTIONS                                         AD  208
      CALL MODEL(K,LPRG,FIT,MNB)                                        AD  209
      IF (IERR.NE.0) RETURN                                             AD  210
C***  STORE UPDATED VALUES                                              AD  211
      DO 57 I=1,10                                                      AD  212
   57 FC(IT+1,I)=CFM(I)                                                 AD  213
      FC(IT+1,11)=FIT(LPRG)                                             AD  214
      DO 58 I=1,K                                                       AD  215
      SF(IT+1,I)=F2(I)                                                  AD  216
   58 SA(IT+1,I)=F6(I)                                                  AD  217
      GO TO 4                                                           AD  218
C***  TEST FIT ERROR                                                    AD  219
   59 IPL=IT+1                                                          AD  220
      FIT(LPRG)=FC(1,11)                                                AD  221
      DO 60 J=1,IPL                                                     AD  222
   60 IF (FC(J,11).LT.FIT(LPRG))FIT(LPRG)=FC(J,11)                      AD  223
      DO 61 J=1,IPL                                                     AD  224
   61 IF (FC(J,11).EQ.FIT(LPRG))MFIT=J                                  AD  225
C***  REDEFINE COEFFICIENTS                                             AD  226
      DO 62 I=1,10                                                      AD  227
   62 CFM(I)=FC(MFIT,I)                                                 AD  228
C***  RESET PITCH ANGLE AND ANGLE OF ATTACK                             AD  229
      DO 63 I=1,K                                                       AD  230
      F2(I)=SF(MFIT,I)                                                  AD  231
   63 F6(I)=SA(MFIT,I)                                                  AD  232
      IUP=1                                                             AD  233
      GO TO 6                                                           AD  234
   64 RETURN                                                            AD  235
      END                                                               AD  236



      SUBROUTINE NEWTON(I,ALP,NCNT)                                     NW    1
C                                                                       NW    2
C***  SUBROUTINE NEWTON USES A MODIFIED SECOND-ORDER NEWTON-RAPHSON     NW    3
C***  METHOD TO ADJUST THE VALUES OF ANGLE OF ATTACK                    NW    4
C                                                                       NW    5
      IMPLICIT REAL*8(A-H,O-Z)                                          NW    6
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F NW    7
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 NW    8
     1),C(450,11),X(450,1),WKAR(250),CFM(14),SGN(4),SGD(4),FT1(450),FT2( NW    9
     1450),PHRA(450),XX(450),YY(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S NW   10
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX NW   11
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                           NW   12
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      COMMON /LAB2/YCEPT,ICD,NTH,NCLCC                                  NW  13
C                                                                       NW  14
C                                                                       NW  15
C***  INITIALIZE PARAMETERS                                             NW  16
      ISZ=0                                                             NW  17
      H=F1(I)                                                           NW  18
      V=F4(I)                                                           NW  19
      R=F5(I)                                                           NW  20
      GD=FT2(I)                                                         NW  21
      HD=F11(I)                                                         NW  22
      P=PHRA(I)                                                         NW  23
      GAM=DARSIN(HD/V)                                                  NW  24
    1 A=F6(I)                                                           NW  25
C***  BEGIN ITERATION                                                   NW  26
      ICK=0                                                             NW  27
    2 A0=A                                                              NW  28
C***  COMPUTE LIFT COEFFICIENT AND DERIVATIVES                          NW  29
      GO TO (3,4,5),ICD                                                 NW  30
    3 IF (A.GT.0.0D0) GO TO 4                                           NW  31
      CL=CFN(12)*A+YCEPT                                                NW  32
      DCL=CFN(12)                                                       NW  33
      DDCL=0.0D0                                                        NW  34
      GO TO 6                                                           NW  35
    4 CL=CFN(11)+CFN(12)*A+CFN(13)*A**EXPX+CFN(14)*F3(I)                NW  36
      DCL=CFN(12)+EXPX*CFN(13)*A**(EXPX-1.0D0)                          NW  37
      DDCL=EXPX*(EXPX-1.0D0)*CFN(13)*A**(EXPX-2.0D0)                    NW  38
      GO TO 6                                                           NW  39
    5 CL=CFN(11)+CFN(12)*A+CFN(13)*A*A+CFN(14)*F3(I)                    NW  40
      DCL=CFN(12)+2.0D0*CFN(13)*A                                       NW  41
      DDCL=2.0D0*CFN(13)                                                NW  42
C***  FORM NEWTON-RAPHSON EQUATION                                      NW  43
    6 H=GD-(G*S*R*V*CL/(2.0D0*M)+G*DSIN(A+TIA)*P/(M*V*V))+G*DCOS(GAM)/V  NW  44
      HP=-((G*S*R*V)/(2.0D0*M)*DCL+G*P*DCOS(A+TIA)/(M*V*V))             NW  45
      XX=DABS((P+M*V*V*V/(DSIN(A+TIA)+1.0D-6))/P)                       NW  46
C***  CHECK FOR NEAR-ZERO SLOPE                                         NW  47
      IF (DABS(HP).LT.1.0D-15.AND.ISZ.EQ.4) GO TO 11                    NW  48
      IF (DABS(HP).GE.1.0D-15) GO TO 7                                  NW  49
      ISZ=ISZ+1                                                         NW  50
C***  MODIFY POWER AND START ITERATION AGAIN                            NW  51
      P=P*XX                                                            NW  52
      GO TO 1                                                           NW  53
    7 HPP=G*P*DSIN(A+TIA)/(M*V*V)-G*S*R*V*DDCL/(2.0D0*M)                NW  54
      RAD=(HP/HPP)*(HP/HPP)-2.0D0*(H/HPP)                               NW  55
C***  ADJUST VALUES OF ANGLE OF ATTACK                                  NW  56
      IF (RAD.LT.0.0D0) GO TO 9                                         NW  57
      IF ((HP*HPP).LT.0.0D0) GO TO 8                                    NW  58
      A=A-HP/HPP+DSQRT(RAD)                                             NW  59
      GO TO 10                                                          NW  60
    8 A=A-HP/HPP-DSQRT(RAD)                                             NW  61
      GO TO 10                                                          NW  62
    9 A=A-HP/HPP                                                        NW  63
      NCNT=NCNT+1                                                       NW  64
      GO TO 11                                                          NW  65
   10 ICK=ICK+1                                                         NW  66
      IF (DABS(A-A0).LE.1.0D-15.OR.ICK.GE.20) GO TO 11                  NW  67
      GO TO 2                                                           NW  68
   11 ALP=A                                                             NW  69
      RETURN                                                            NW  70
      END                                                               NW  71
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      SUBROUTINE MODEL(K,LPRG,FIT,NUB)                                  MD   1
C                                                                       MD   2
C***  SUBROUTINE MODEL CALCULATES THE POWER AND DRAG COEFFICIENTS OF THE MD   3
C***  SPECIFIED MODELS FROM THE EQUATION OF MOTION TANGENT TO THE FLIGHT MD   4
C***  PATH                                                              MD   5
C                                                                       MD   6
      IMPLICIT REAL*8(A-H,O-Z)                                          MD   7
      DIMENSION FIT(2),ST(18,11),TS(10),LOC(10,18)                      MD   8
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F MD   9
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 MD  10
     1),C(450,11),X(450,1),WKAR(250),CFN(14),SGN(4),SGD(4),FT1(450),FT2( MD  11
     1450),PHRA(450),CL(450),XX(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S MD  12
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX MD  13
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                           MD  14
      INTEGER IEQN(18)/3,4,5,7,4,5,7,5,6,8,5,6,8,4,5,5,6,6/             MD  15
      DATA LOC/1,6,8,0,0,0,0,0,0,0,1,2,6,8,0,0,0,0,0,0,1,2,6,8,10,0,0,0, MD  16
     10,0,1,2,6,7,8,9,10,0,0,0,1,3,6,8,0,0,0,0,0,0,1,3,6,8,10,0,0,0,0,0, MD  17
     11,3,6,7,8,9,10,0,0,0,0,1,2,3,6,8,0,0,0,0,0,0,1,2,3,6,8,10,0,0,0,0,1,2, MD  18
     13,6,7,8,9,10,0,0,0,1,3,4,6,8,0,0,0,0,0,0,1,3,4,6,8,10,0,0,0,0,0,1,3,4,6, MD  19
     17,8,9,10,0,0,0,1,6,7,8,0,0,0,0,0,0,0,1,2,6,7,8,0,0,0,0,0,0,1,3,6,7,8,0,0 MD  20
     1,0,0,0,1,2,3,6,7,8,0,0,0,0,0,1,3,4,6,7,8,0,0,6,0,0/              MD  21
C                                                                       MD  22
      WRITE (JWRITE,1)                                                  MD  23
    1 FORMAT (1X,////,50X,29HM O D E L   S O L U T I O N S,/)           MD  24
      WRITE (JWRITE,2)                                                  MD  25
    2 FORMAT (28X,76('*'),/,28X,'*',74X,'*')                           MD  26
C***  BEGIN ANALYSIS ON SPECIFIED MODELS                                MD  27
      DO 14 LKNN=L1,L2                                                  MD  28
C***  DETERMINE SPECIFIC MODEL AND NUMBER OF UNKNOWNS                   MD  29
      JCNT=IEQNN(LKNN)                                                  MD  30
      NUB=IEQN(JCNT)                                                    MD  31
      NFL=0                                                             MD  32
      CALL CHNGE(SGN)                                                   MD  33
      DO 4 I=1,K                                                        MD  34
      AR=DABS(F6(I))                                                    MD  35
C***  TEST FOR NEGATIVE ANGLES OF ATTACK                                MD  36
      IF (F6(I).LT.0.0D0) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)           MD  37
C***  DETERMINE GENERAL TERMS FOR MATRIX FORMULATION                    MD  38
      TS(1)=DCOS(F6(I)+TIA)/(F1(I)*F4(I))                               MD  39
      TS(2)=TS(1)*F4(I)**EX1                                            MD  40
      TS(3)=TS(1)*F4(I)**EX2                                            MD  41
      TS(4)=TS(1)*F4(I)**EX3                                            MD  42
      TS(5)=TS(1)*F4(I)**EX4                                            MD  43
      TS(6)=-F5(I)*S*F4(I)**2/(2.0D0*F1(I))                             MD  44
      TS(7)=TS(6)*SGN(1)*AR**IEX1                                       MD  45
      TS(8)=TS(6)*SGN(2)*AR**IEX2                                       MD  46
      TS(9)=TS(6)*SGN(3)*AR**IEX3                                       MD  47
      TS(10)=TS(6)*SGN(4)*AR**IEX4                                      MD  48
      IF (F6(I).LT.0.0D0) CALL CHNGE(SGN)                               MD  49
C***  FORM COEFFICIENTS FOR LEAST SQUARES                               MD  50
      DO 3 J=1,NUB                                                      MD  51
    3 C(I,J)=TS(LOC(J,JCNT))                                            MD  52
    4 X(I,1)=F8(I)/G*DSIN(F2(I)-F6(I))                                  MD  53
C***  EXACT LEAST SQUARES                                               MD  54
      CALL LLSQAR(C,X,K,IEQN(JCNT),1,450,450,16,WKAR,IER,JWRITE)        MD  55
C***  CHECK FOR ERROR                                                   MD  56
      IF (IER.EQ.129) GO TO 5                                           MD  57
      GO TO 7                                                           MD  58
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      5 WRITE (JWRITE,6)                                                    MD   59
      6 FORMAT (1X,//,10X,'ZERO MATRIX ENCOUNTERED IN MODEL.  TO EXIT DATA  MD   60
     1 SET, IF ANY.',//)                                                    MD   61
        IERR=1                                                              MD   62
        RETURN                                                              MD   63
C***  STORE VALUES FOR COMPARISON                                           MD   64
      7 DO 8 J=1,10                                                         MD   65
      8 ST(JCNT,J)=X(J,1)                                                   MD   66
C***  DEFINE COEFFICIENTS IN CORRECT ORDER                                  MD   67
        DO 9 J=1,10                                                         MD   68
      9 CFN(J)=0.0D0                                                        MD   69
        DO 10 J=1,NUM                                                       MD   70
     10 CFN(LOC(J,JCNT))=X(J,1)                                             MD   71
C***  DETERMINE FIT ERROR                                                   MD   72
        SSX=0.0D0                                                           MD   73
        DO 11 J=1,K                                                         MD   74
        AM=DABS(F6(J))                                                      MD   75
        IF (F6(J).LT.0.0D0) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)             MD   76
        P=CFN(1)+CFN(2)*F4(J)**EX1+CFN(3)*F5(J)**EX2+CFN(4)*F4(J)**EX3+CFN  MD   77
     1(5)*F4(J)**EX4                                                        MD   78
        CD=CFN(6)+CFN(7)*SGN(1)*AB**IEX1+CFN(8)*SGN(2)*AM**IEX2+CFN(9)*SGN  MD   79
     1(3)*AM**IEX3+CFN(10)*SGN(4)*AM**IEX4                                  MD   80
C***  CHECK POWER AND DRAG COEFFICIENT RANGE                                MD   81
        IF ((P.LE.PLOW.OR.P.GT.PHIGH).OR.(CD.LT.CDLOW.OR.CD.GE.CDHIGH))NFL  MD   82
        1=NFL+1                                                             MD   83
        SS=DCOS(F6(J)+TIA)*P/(F1(J)*F4(J))-(F5(J)*S*F4(J)**2/(2.0D0*F1(J))  MD   84
     1*CD+F8(J)/G+DSIN(F2(J)-F6(J)))                                        MD   85
     11 SSX=SSX+SS*SS                                                       MD   86
        IF (NFL.GT.0) SSX=1.0D+60                                           MD   87
C***  WRITE MODEL VALUES                                                    MD   88
        IF (METRIC.NE.0) GO TO 13                                           MD   89
        WRITE (JWRITE,12) JCNT,CFN(1),CFN(6),CFN(2),CFN(7),CFN(3),CFN(8),C  MD   90
     1FN(4),CFN(9),NFL,CFN(5),CFN(10),SSX                                   MD   91
     12 FORMAT (28X,'*',1X,'MODEL ',I2,3X,'P0 = ',1PD23.16,3X,'CD0 = ',1PD  MD   92
     123.16,2X,'*',/,28X,'*',12X,'P1 = ',1PD23.16,3X,'CD1 = ',1PD23.16,2    MD   93
     1X,'*',/,28X,'*',1X,'POINT',6X,'P2 = ',1PD23.16,3X,'CD2 = ',1PD23.1    MD   94
     16,2X,'*',/,28X,'*',1X,'FAILURES',3X,'P3 = ',1PD23.16,3X,'CD3 = ',1    MD   95
     1PD23.16,2X,'*',/,28X,'*',1X,'=',I4,6X,'P4 = ',1PD23.16,3X,'CD4 = '    MD   96
     1,1PD23.16,2X,'*',/,28X,'*',74X,'*',/,28X,'*',1X,'FIT ERROR= ',D23.    MD   97
     116,39X,'*',/,28X,'*',74X,'*',/,28X,'*',74('.'),'*',/,28X,'*',74X,'    MD   98
     1*')                                                                   MD   99
        GO TO 14                                                            MD  100
     13 P0=CFN(1)*1.355818D-3                                               MD  101
        P1=CFN(2)*1.355818D-3                                               MD  102
        P2=CFN(3)*1.355818D-3                                               MD  103
        P3=CFN(4)*1.355818D-3                                               MD  104
        P4=CFN(5)*1.355818D-3                                               MD  105
        WRITE (JWRITE,12) JCNT,P0,CFN(6),P1,CFN(7),P2,CFN(8),P3,CFN(9),NFL  MD  106
     1,P4,CFN(10),SSX                                                       MD  107
     14 ST(JCNT,11)=SSX                                                     MD  108
C***  DETERMINE BEST MODEL BY FIT ERROR                                     MD  109
        ICC=IEQNN(1)                                                        MD  110
        FIT(LPNG)=ST(ICC,11)                                                MD  111
        DO 15 J=L1,L2                                                       MD  112
        ICC=IEQNN(J)                                                        MD  113
     15 IF (ST(ICC,11).LT.FIT(LPNG))FIT(LPNG)=ST(ICC,11)                    MD  114
        DO 16 J=L1,L2                                                       MD  115
        ICC=IEQNN(J)                                                        MD  116
     16 IF (ST(ICC,11).EQ.FIT(LPNG))NNB=ICC                                 MD  117
        WRITE (JWRITE,2)                                                    MD  118
        IF (FIT(LPNG).EQ.1.0D+60) GO TO 18                                  MD  119
        WRITE (JWRITE,17) NNB                                               MD  120
     17 FORMAT (28X,'***',21X,'MODEL ',I2,' FOUND TO BE BEST FIT',22X,'***',  MD  121
     1/,28X,'*',74X,'*',/,28X,76('*'),////)                                 MD  122
        GO TO 20                                                            MD  123
     18 WRITE (JWRITE,19)                                                   MD  124
     19 FORMAT (28X,'***',21X,'NO MODEL FOUND TO BE ADEQUATE',22X,'***',/,28  MD  125
     1X,'*',74X,'*',/,28X,76('*'),////)                                     MD  126
C***  UPDATE COEFFICIENT VALUES                                             MD  127
     20 DO 21 J=1,10                                                        MD  128
     21 CFN(J)=0.0D0                                                        MD  129
        NUM=IEQN(NNB)                                                       MD  130
        DO 22 J=1,NUM                                                       MD  131
     22 CFN(LOC(J,NNB))=ST(NNB,J)                                           MD  132
        RETURN                                                              MD  133
        END                                                                 MD  134
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      SUBROUTINE F(T,X,DX,C,NJK,J,IPATH,MCNT,NCNT)                          FP    1
C                                                                           FP    2
C***  SUBROUTINE F USES THE HORIZONTAL- AND VERTICAL-PLANE EQUATIONS OF      FP    3
C***  MOTION TO COMPUTE COMPATIBLE FLIGHT PATH PARAMETERS                   FP    4
C                                                                           FP    5
      IMPLICIT REAL*8(A-H,O-Z)                                              FP    6
      EXTERNAL VA,DDV,DDDV,ALP,DVA,PHIDER                                   FP    7
      DIMENSION X(4),DX(4),CX(6)                                            FP    8
      COMMON T8(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F7(    FP    9
     1450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450),    FP   10
     1Z(450,11),X(450,1),NKAR(250),CFN(14),SGN(4),SGD(4),FT1(450),FT2(45    FP   11
     10),PHRA(450),XI(450),YI(450),Z1(450),Z2(450),EX1,EX2,EX3,EX4,G,S,R    FP   12
     1NO,TIA,EXPI,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX2,    FP   13
     1IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                                 FP   14
      COMMON /LAB0/ALP1,P1,PAC(8),CL,CD                                     FP   15
C                                                                           FP   16
C***  CALCULATE AIRCRAFT HEIGHT                                             FP   17
      IF (J.NE.1) GO TO 1                                                   FP   18
      Y(1)=F1(J)                                                            FP   19
      GO TO 2                                                               FP   20
    1 Y(1)=Y(1)+DX(1)*(T-T8(J-1))+DYN*(T-T8(J-1))**2/2.0D0+DDYN*(T-T8(J-    FP   21
     11))**3/6.0D0                                                          FP   22
C***  COMPUTE DENSITY FACTOR                                                FP   23
    2 PH=(1.0D0-6.86D-6*Y(2))**4.26D0                                       FP   24
C***  INITIALIZE PARAMETERS                                                 FP   25
      ICNT=0                                                                FP   26
      A=F6(J)                                                               FP   27
      TD=F3(J)                                                              FP   28
      C1=(2.0D0*Y(1)/(G*S*RHO*PH*Y(3)))*(DX(4)+G*DCOS(X(4))/Y(3))           FP   29
      C2=2.0D0*Y(1)/(G*S*RHO*PH*Y(3)*Y(3))                                  FP   30
      C3=C2*(DX(3)+G*DSIN(X(4)))                                            FP   31
C***  START NEWTON-RAPHSON ITERATION                                        FP   32
      JR=0                                                                  FP   33
    3 ICNT=ICNT+1                                                           FP   34
C***  CALCULATE CL, CD, AND THEIR DERIVATIVES                               FP   35
      CALL CLCD(JR,A,TD,CFN,IEX1,IEX2,IEX3,IEX4,EXPI,CX)                    FP   36
C***  CALCULATE NEWTON-RAPHSON EQUATIONS                                    FP   37
      FX=CX(1)+DTAN(A)*(C3+CX(2))-C1                                        FP   38
      F1P=CX(3)+(C3+CX(2))/(DCOS(A)*DCOS(A))+DTAN(A)*CX(5)                  FP   39
      F1PP=CX(4)+(2.0D0*CX(5)+2.0D0*(C3+CX(2))*DTAN(A))/DCOS(A)**2+CX(6)    FP   40
     1*DTAN(A)                                                              FP   41
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C***  SOLVE FOR ANGLE OF ATTACK                                          FP   42
      RAD=(F1P/F1PP)*(F1P/F1PP)-2.0D0*(FX/F1PP)                          FP   43
      A1=A                                                              FP   44
      IF (RAD.LT.0.0D0) GO TO 5                                         FP   45
      IF ((F1P*F1PP).LT.0.0D0) GO TO 4                                  FP   46
      A=A-F1P/F1PP+DSQRT(RAD)                                           FP   47
      GO TO 6                                                           FP   48
    4 A=A-F1P/F1PP-DSQRT(RAD)                                           FP   49
      GO TO 6                                                           FP   50
    5 A=A-F1P/F1PP                                                      FP   51
      NCNT=NCNT+1                                                       FP   52
      GO TO 7                                                           FP   53
C***  TEST FOR CONVERGENCE OR MAXIMUM ITERATION                         FP   54
    6 IF (DABS(A1-A).LT.1.0D-15.OR.ICNT.EQ.20) GO TO 7                  FP   55
      GO TO 3                                                           FP   56
C***  UPDATE CL, CD, POWER, AND WEIGHT DERIVATIVES                      FP   57
    7 JR=1                                                              FP   58
      ALP1=A                                                            FP   59
      CALL CLCD(JR,A,TD,CFN,IER1,IEX2,IEX3,IEX4,EXPX,CX)                FP   60
      CL=CX(1)                                                          FP   61
      CD=CX(2)                                                          FP   62
      P1=Y(1)*Y(3)/(G*DCOS(ALP1+TIA))*(DY(3)+G*S*RHO*FH*Y(3)**2*CX(2)/(2 FP   63
     1.0D0*Y(1))+G*DSIN(Y(4)))                                          FP   64
      IF (P1.LT.0.0D0)IERR=1                                            FP   65
      IF (IERR.NE.0) RETURN                                             FP   66
      DY(1)=-C*P1                                                       FP   67
      DXW=-C*DY(3)*(EX1*CFN(2)*Y(3)**(EX1-1.0D0)+EX2*CFN(3)*Y(3)**(EX2-1 FP   68
     1.0D0)+EX3*CFN(4)*Y(3)**(EX3-1.0D0)+EX4*CFN(5)*Y(3)**(EX4-1.0D0))  FP   69
      DDF=DDY(I)                                                        FP   70
      DDXW=-C*(EX1*CFN(2)*((EX1-1.0D0)*Y(3)**(EX1-2.0D0)*DY(3)+Y(3)**(EX FP   71
     11-1.0D0)*DDF)+EX2*CFN(3)*((EX2-1.0D0)*Y(3)**(EX2-2.0D0)*DY(3)+Y(3) FP   72
     1**(EX2-1.0D0)*DDF)+EX3*CFN(4)*((EX3-1.0D0)*Y(3)**(EX3-2.0D0)*DY(3) FP   73
     1+Y(3)**(EX3-1.0D0)*DDF)+EX4*CFN(5)*((EX4-1.0D0)*Y(3)**(EX4-2.0D0)* FP   74
     1DY(3)+Y(3)**(EX4-1.0D0)*DDF))                                     FP   75
C***  COMPUTE PARTIAL DERIVATIVES OF EQUATION OF MOTION                 FP   76
      IF (KJK.EQ.2) GO TO 8                                             FP   77
      B1=RHO*FH                                                         FP   78
      CALL PARTAL(J,Y(1),B1,ALP1,Y(3),DY(3),DY(2),Y(4),DY(4),PAC,NCNT)  FP   79
    8 RETURN                                                            FP   80
      END                                                               FP   81



      SUBROUTINE PATH(N,C,IPATH)                                        PH    1
C                                                                       PH    2
C***  SUBROUTINE PATH INTEGRATES THE VEHICLE EQUATIONS OF MOTION TO     PH    3
C***  OBTAIN TIME HISTORIES OF BOTH VEHICLE AND FLIGHT PATH PARAMETERS  PH    4
C                                                                       PH    5
      IMPLICIT REAL*8(A-H,O-Z)                                          PH    6
      DIMENSION DY(4),Y(4),SC(450,8)                                    PH    7
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F PH    8
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 PH    9
     1),Z(450,11),X(450,1),WKAR(250),CFN(14),SGN(4),SGD(4),FT1(450),FT2( PH   10
     1450),PHRA(450),XX(450),YY(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S PH   11
     1,RHO,TIA,EXPX,FLOW,FHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEK1,IEX PH   12
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                           PH   13
      COMMON /LAB8/ALP1,P1,PAC(8),CL,CD                                 PH   14
      COMMON /LAB9/ADF(450)                                             PH   15
C                                                                       PH   16
C***  INITIALIZE PARAMETERS                                             PH   17
      GAMMAX=1.0D0                                                      PH   18
      WMIN=80.0D0                                                       PH   19
      CALL CHNGE(SGN)                                                   PH   20
C***  WRITE HEADER TITLE                                                PH   21
      WRITE (JWRITE,1) IPATH                                            PH   22
    1 FORMAT (1X,///,43X,47('*'),/,43X,'*',45X,'*',/,43X,'*',2X,'PATH PE PH   23
     1RFORMANCE ANALYSIS ITERATION NO.',I2,2X,'*',/,43X,'*',3X,'(ALTITUD PH   24
     1E AND AIRSPEED ASSUMED CORRECT)',3X,'*',/,43X,'*',45X,'*',/,43X,47 PH   25
     1('*'),//)                                                         PH   26
C***  COMPUTE ACCELERATION DERIVATIVE                                   PH   27
      IF (IPATH.NE.1) GO TO 2                                           PH   28
      CALL FNI(N,F8,TIME,FT1,FT2,0,15,3,2)                              PH   29
C***  COMPUTE MINIMUM WEIGHT                                            PH   30
    2 WEMPTY=P1(N)-1.0D0                                                PH   31
C***  BEGIN LOOP FOR CORRECTIONS                                        PH   32
      DO 16 KJK=1,2                                                     PH   33
C***  WRITE LABELS IN ENGLISH OR SI UNITS                               PH   34
      IF (METRIC.EQ.0) WRITE (JWRITE,3) KJK                             PH   35
      IF (METRIC.NE.0) WRITE (JWRITE,4) KJK                             PH   36
    3 FORMAT (1X,/,51X,'PATH PERFORMANCE SUBITERATION',I2,//,13X,'TIME', PH   37
     17X,'ALTITUDE',5X,'AIRSPEED',6X,'GAMMA',7X,'ALPHA',10X,'CL',11X,'CD PH   38
     1',9X,'WEIGHT',9X,'POWER',/,12X,'(SECS)',8X,'(FT)',7X,'(FT/SEC)',6X PH   39
     1,'(RAD)',7X,'(RAD)',35X,'(LBF)',6X,'(FT-LBF/SEC)',/)              PH   40
    4 FORMAT (1X,/,51X,'PATH PERFORMANCE SUBITERATION',I2,//,13X,'TIME', PH   41
     17X,'ALTITUDE',5X,'AIRSPEED',6X,'GAMMA',7X,'ALPHA',10X,'CL',11X,'CD PH   42
     1',9X,'WEIGHT',9X,'POWER',/,12X,'(SECS)',6X,'(METERS)',6X,'(M/SEC)' PH   43
     1,6X,'(RAD)',7X,'(RAD)',33X,'(NEWTONS)',2X,'(KW)',/)               PH   44
C***  BEGIN INTEGRATION                                                 PH   45
      I=1                                                               PH   46
      T=TIME(I)                                                         PH   47
      Y(1)=F1(I)                                                        PH   48
      Y(2)=F10(I)                                                       PH   49
      Y(3)=F4(I)                                                        PH   50
      Y(4)=FT1(I)                                                       PH   51
      DY(2)=F11(I)                                                      PH   52
      DY(3)=F8(I)                                                       PH   53
      DY(4)=FT2(I)                                                      PH   54
      NCNT=0                                                            PH   55
      NCNT=0                                                            PH   56
C***  ENACT SOLUTION ROUTINE                                            PH   57
      CALL F(T,Y,DY,C,KJK,I,IPATH,NCNT,NCNT)                            PH   58
C***  CHECK FOR ERROR                                                   PH   59
      IF (IERR.NE.0) RETURN                                             PH   60
C***  WRITE RESULTS                                                     PH   61
      IF (METRIC.NE.0) GO TO 6                                          PH   62
      WRITE (JWRITE,5) T,Y(2),Y(3),Y(4),ALP1,CL,CD,Y(1),P1              PH   63
    5 FORMAT (9X,9(1PD12.5,1X))                                         PH   64
      GO TO 7                                                           PH   65
    6 HS=Y(1)*4.4482D0                                                  PH   66
      HS=Y(2)*0.3048D0                                                  PH   67
      VS=Y(3)*0.3048D0                                                  PH   68
      P1S=P1*1.3558D0/1000.0D0                                          PH   69
      WRITE (JWRITE,5) T,HS,VS,Y(4),ALP1,CL,CD,WS,P1S                   PH   70
C***  STORE ANGLE OF ATTACK DIFFERENCE AND PARTIAL DERIVATIVES          PH   71
    7 ADF(I)=ALP1-F6(I)                                                 PH   72
      IF (KJK.EQ.2) GO TO 9                                             PH   73
      DO 8 L=1,8                                                        PH   74
    8 SC(I,L)=PAC(L)                                                    PH   75
C***  CONTINUE INTEGRATION                                              PH   76
    9 DO 13 I=2,N                                                       PH   77
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      T=TIME(I)                                                          PH   78
      Y(1)=P1(I)                                                         PH   79
      Y(2)=P10(I)                                                        PH   80
      Y(3)=P4(I)                                                         PH   81
      Y(4)=PT1(I)                                                        PH   82
      DY(2)=P11(I)                                                       PH   83
      DY(3)=P8(I)                                                        PH   84
      DY(4)=PT2(I)                                                       PH   85
C***  EXACT SOLUTION ROUTINE                                             PH   86
      CALL F(T,Y,DY,C,KJK,I,IPATH,NCNT,NCNT)                             PH   87
C***  CHECK FOR ERROR                                                    PH   88
      IF (IERR.NE.0) RETURN                                              PH   89
C***  CHECK FOR TOLERANCE LIMITS                                         PH   90
      IF (Y(1).LT.WEMPTY) GO TO 17                                       PH   91
      IF (Y(2).LT.0.0D0) GO TO 19                                        PH   92
      IF (DABS(Y(4)).GT.GAMMAX) GO TO 21                                 PH   93
      IF (Y(3).LT.VMIN) GO TO 23                                         PH   94
C***  WRITE RESULTS                                                      PH   95
      IF (METRIC.NE.0) GO TO 10                                          PH   96
      WRITE (JWRITE,5) T,Y(2),Y(3),Y(4),ALP1,CL,CD,Y(1),P1               PH   97
      GO TO 11                                                           PH   98
   10 WS=Y(1)*4.4482D0                                                   PH   99
      HS=Y(2)*0.3048D0                                                   PH  100
      VS=Y(3)*0.3048D0                                                   PH  101
      P1S=P1*1.3558D0/1000.0D0                                           PH  102
      WRITE (JWRITE,5) T,HS,VS,Y(4),ALP1,CL,CD,WS,P1S                    PH  103
C***  STORE ANGLE OF ATTACK                                              PH  104
   11 ADF(I)=ALP1-P6(I)                                                  PH  105
      IF (KJK.EQ.2) GO TO 13                                             PH  106
      DO 12 L=1,8                                                        PH  107
   12 SC(I,L)=PAC(L)                                                     PH  108
   13 CONTINUE                                                           PH  109
      IF (NCNT.NE.0) WRITE (JWRITE,14) NCNT                              PH  110
   14 FORMAT (1X,///,9X,94H*** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK PH  111
     1IN    F    , ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)   PH  112
      IF (KJK.EQ.2) GO TO 16                                             PH  113
      IF (NCNT.NE.0) WRITE (JWRITE,15) NCNT                              PH  114
   15 FORMAT (1X,///,9X,94H*** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK PH  115
     1IN PARTAL, ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)     PH  116
C***  CALL DELTA CORRECTION ROUTINE                                      PH  117
      CALL DCB(N,ADF,SC,CFN,JWRITE)                                      PH  118
   16 CONTINUE                                                           PH  119
      RETURN                                                             PH  120
C***  ERROR MESSAGES (TERMINATING)                                       PH  121
   17 WRITE (JWRITE,18)                                                  PH  122
   18 FORMAT (1X,///,10X,'AIRCRAFT WEIGHT MINIMUM DECREASED BY 1 LBF OR 4 PH  123
     1.482 NEWTONS. DATA REJECTED.')                                     PH  124
      GO TO 25                                                           PH  125
   19 WRITE (JWRITE,20)                                                  PH  126
   20 FORMAT (1X,///,10X,'ALTITUDE BECAME LESS THAN ZERO. DATA REJECTED.' PH  127
     1)                                                                  PH  128
      GO TO 25                                                           PH  129
   21 WRITE (JWRITE,22)                                                  PH  130
   22 FORMAT (1X,///,10X,'ABSOLUTE VALUE OF FLIGHT PATH ANGLE EXCEEDED 1 PH  131
     1RADIAN. DATA REJECTED.')                                           PH  132
      GO TO 25                                                           PH  133
   23 WRITE (JWRITE,24)                                                  PH  134
   24 FORMAT (1X,///,10X,'AIRSPEED BECAME LESS THAN THE MINIMUM SPEED. DA PH  135
     1TA REJECTED.')                                                     PH  136
   25 IERR=1                                                             PH  137
      RETURN                                                             PH  138
      END                                                                PH  139


      SUBROUTINE PARTAL(J,W,R,ALP,V,DV,DH,FPA,DFPA,PAC,NCNT)             PR    1
C                                                                        PR    2
C***  SUBROUTINE PARTAL COMPUTES NUMERICALLY THE PARTIAL DERIVATIVES OF   PR    3
C***  THE LIFT AND DRAG COEFFICIENTS                                     PR    4
C                                                                        PR    5
      IMPLICIT REAL*8(A-H,O-Z)                                           PR    6
      DIMENSION CX(8),PAC(8),FX(2),CXX(6)                                PR    7
      COMMON TIME(450),P1(450),P2(450),P3(450),P4(450),P5(450),P6(450),P PR    8
     17(450),P8(450),P9(450),P10(450),P11(450),P12(450),P13(450),P14(450 PR    9
     1),C(450,11),X(450,1),NKAR(250),CFN(14),SGN(4),SGD(4),PT1(450),PT2( PR   10
     1450),PHRA(450),CL(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S PR   11
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX PR   12
     12,IEX3,IEX4,METRIC,L1,L2,IEQUN(18),IERR                            PR   13
C                                                                        PR   14
C***  INITIALIZE FACTORS AND PARAMETERS                                  PR   15
      FX(1)=0.99D0                                                       PR   16
      FX(2)=1.01D0                                                       PR   17
      TD=P3(J)                                                           PR   18
      IN=0                                                               PR   19
      JC=1                                                               PR   20
C***  STORE LIFT AND DRAG COEFFICIENTS                                   PR   21
      DO 1 I=1,8                                                         PR   22
    1 CX(I)=CFN(I+5)                                                     PR   23
C***  COMPUTE COEFFICIENTS FOR EQUATION OF MOTION                        PR   24
      C1=(2.0D0*W/(G*S*R*V))*(DFPA+G*DCOS(FPA)/V)                        PR   25
      C2=2.0D0*W/(G*S*R*V*V)                                             PR   26
      C3=C2*(DV+G*DSIN(FPA))                                             PR   27
C***  BEGIN COMPUTATION OF PARTIAL DERIVATIVES                           PR   28
      DO 9 JX=1,16                                                       PR   29
      A=ALP                                                              PR   30
      IF (IN.EQ.2)JC=JC+1                                                PR   31
      IN=1                                                               PR   32
      IF (((JX/2)*2).EQ.JX)IN=2                                          PR   33
C***  TEST FOR ZERO COEFFICIENT                                          PR   34
      IF (CX(JC).NE.0.0D0) GO TO 2                                       PR   35
      PAC(JC)=0.0D0                                                      PR   36
      GO TO 9                                                            PR   37
C***  MODIFY COEFFICIENT                                                 PR   38
    2 CFN(JC+5)=CX(JC)*FX(IN)                                            PR   39
      ICNT=0                                                             PR   40
    3 ICNT=ICNT+1                                                        PR   41
      JR=0                                                               PR   42
C***  COMPUTE CL, CD, AND THEIR DERIVATIVES                              PR   43
      CALL CLCD(JR,A,TD,CFN,IEX1,IEX2,IEX3,IEX4,EXPX,CXX)                PR   44
C***  FORM NEWTON-RAPHSON EQUATIONS                                      PR   45
      FY=CXX(1)*DTAN(A)*(C3+CXX(2))-C1                                   PR   46
      F1P=CXX(3)*(C3+CXX(2))/(DCOS(A)*DCOS(A))+DTAN(A)*CXX(5)            PR   47
      F1PP=CXX(4)*(2.0D0*CXX(5)+2.0D0*(C3+CXX(2))*DTAN(A))/(DCOS(A)*DCOS PR   48
     1(A))+CXX(6)*DTAN(A)                                                PR   49
C***  SOLVE FOR ANGLE OF ATTACK                                          PR   50
      RAD=(F1P/F1PP)*(F1P/F1PP)-2.0D0*(FY/F1PP)                          PR   51
      A5=A                                                               PR   52
      IF (RAD.LT.0.0D0) GO TO 5                                          PR   53
      IF ((F1P/F1PP).LT.0.0D0) GO TO 4                                   PR   54
      A=A-F1P/F1PP+DSQRT(RAD)                                            PR   55
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      GO TO 6
    4 A=A-F1P/F1PP-DSQRT(RAD)
      GO TO 6
    5 A=A-F1P/F1PP
      ICNT=ICNT+1
      GO TO 7
    6 IF (DABS(AS-A).LT.1.0D-15.OR.ICNT.GE.20) GO TO 7
      GO TO 3
    7 IF (((JX/2)*2).NE.JX)A1=A
      IF (((JX/2)*2).EQ.JX)A2=A
      IF (((JX/2)*2).EQ.JX) GO TO 8
      GO TO 9
C***  COMPUTE PARTIAL DERIVATIVES AND RESET COEFFICIENTS
    8 PAC(JC)=(A2-A1)/(PX(2)-PX(1))/CX(JC)
      CFR(JC+5)=CX(JC)
    9 CONTINUE
      RETURN
      END



      SUBROUTINE FITERR(F,I,X)
C
C***  SUBROUTINE FITERR CHECKS FIT ERRORS AND STORES
C***  'BEST' MODEL EXTRACTION COEFFICIENTS
C
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION X(14),XX(14)
C
      IF (I.NE.1) GO TO 3
    1 F1=F
      DO 2 J=1,14
    2 XX(J)=X(J)
      RETURN
    3 F2=F
      IF (F2.LT.F1) GO TO 1
      F=F1
      DO 4 J=1,14
    4 X(J)=XX(J)
      RETURN
      END



      SUBROUTINE ASCEN(N,Y,X,YY,XX)
C
C***  SUBROUTINE ASCEN ORDERS DATA OF X VS. Y BY ASCENDING X
C
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION Y(N),YY(N),X(N),XX(N)
C
C***  STORE INPUT VALUES
      DO 1 J=1,N
      YY(J)=Y(J)
    1 XX(J)=X(J)
      NM1=N-1
C***  ARRANGE IN ASCENDING ORDER
      DO 3 J=1,NM1
      M=J
      MP1=J+1
      DO 2 I=MP1,N
    2 IF (XX(I).LT.XX(M))M=I
      T1=XX(J)
      T2=YY(J)
      XX(J)=XX(M)
      YY(J)=YY(M)
      XX(M)=T1
    3 YY(M)=T2
      RETURN
      END



      SUBROUTINE CLCD(L,A,PR,C,IEX1,IEX2,IEX3,IEX4,EX,B)
C
C***  SUBROUTINE CLCD CALCULATES LIFT AND DRAG COEFFICIENTS AND THEIR
C***  DERIVATIVES WHEN NEEDED
C
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION C(14),B(6),S(4)
      COMMON /LAB2/XCEPT,ICD,MTH,MCLCC
C
C***  COMPUTE DRAG COEFFICIENTS AND DERIVATIVES
      CALL CHNGE(S)
      IF (A.LT.0.0D0) CALL SIGNS(S,IEX1,IEX2,IEX3,IEX4)
      AM=DABS(A)
      B(2)=C(6)+S(1)*C(7)*AM**IEX1+S(2)*C(8)*AM**IEX2+S(3)*C(9)*AM**IEX3
     1+S(4)*C(10)*AM**IEX4
      IF (A.LT.0.0D0) CALL CHNGE(S)
      IF (L.NE.0) GO TO 1
      L1=IEX1-1
      L2=IEX2-1
      L3=IEX3-1
      L4=IEX4-1
      L5=L1-1
      L6=L2-1
      L7=L3-1
      L8=L4-1
      IF (A.LT.0.0D0) CALL SIGNS(S,L1,L2,L3,L4)
      B(5)=S(1)*IEX1*C(7)*AM**L1+S(2)*IEX2*C(8)*AM**L2+S(3)*IEX3*C(9)*AM
     1**L3+S(4)*IEX4*C(10)*AM**L4
      IF (A.LT.0.0D0) CALL SIGNS(S,L5,L6,L7,L8)
      B(6)=S(1)*IEX1*L1*C(7)*AM**L5+S(2)*IEX2*L2*C(8)*AM**L6+S(3)*IEX3*L
     13*C(9)*AM**L7+S(4)*IEX4*L4*C(10)*AM**L8
      IF (A.LT.0.0D0) CALL CHNGE(S)
C***  CHECK FORM FOR LIFT COEFFICIEET EXPRESSION
    1 GO TO (2,3,4),ICD
C***  COMPUTE LIFT COEFFICIENT AND DERIVATIVES
    2 IF (A.GT.0.0D0) GO TO 3
      B(1)=C(12)*A+Y+C(14)*PR
      IF (L.NE.0) GO TO 5
      B(3)=C(12)
      B(4)=0.0D0
      GO TO 5
    3 B(1)=C(11)+C(12)*A+C(13)*A**EX+C(14)*PR
      IF (L.NE.0) GO TO 5
      B(3)=C(12)+EX*C(13)*A**(EX-1.0D0)
      B(4)=EX*(EX-1.0D0)*C(13)*A**(EX-2.0D0)
      GO TO 5
    4 B(1)=C(11)+C(12)*A+C(13)*A*A+C(14)*PR
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      IF (L.NE.0) GO TO 5                                               CD  48
      B(3)=C(12)+2.0D0*C(13)*A                                          CD  49
      B(4)=2.0D0*C(13)                                                  CD  50
    5 RETURN                                                            CD  51
      END                                                               CD  52


      SUBROUTINE DCR(N,AD,P,C,JWRITE)                                   DC   1
C                                                                       DC   2
C***  SUBROUTINE DCR SOLVES FOR DELTA CORRECTIONS TO BE APPLIED TO LIFT  DC   3
C***  AND DRAG COEFFICIENTS                                             DC   4
C                                                                       DC   5
      IMPLICIT REAL*8(A-H,O-Z)                                          DC   6
      DIMENSION AD(450),P(450,8),C(14),F(8),A(8,2),B(8)                 DC   7
C                                                                       DC   8
C***  INITIALIZE FACTORS AND COEFFICIENTS                               DC   9
      DO 1 J=1,8                                                        DC  10
      F(J)=1.0D0                                                        DC  11
      IF (C(J+5).EQ.0.0D0)F(J)=0.0D0                                    DC  12
      A(J,1)=0.0D0                                                      DC  13
    1 A(J,2)=0.0D0                                                      DC  14
C***  SUM PRODUCTS OF PARTIALS                                          DC  15
      DO 2 J=1,N                                                        DC  16
      DO 2 L=1,8                                                        DC  17
      A(L,1)=A(L,1)+P(J,L)*P(J,L)*F(L)                                  DC  18
    2 A(L,2)=A(L,2)+P(J,L)*AD(J)*F(L)                                   DC  19
C***  INITIALIZE DELTA CORRECTIONS                                      DC  20
      DO 3 L=1,8                                                        DC  21
    3 B(L)=0.0D0                                                        DC  22
C***  CALCULATE CORRECTIONS                                             DC  23
      DO 4 L=1,8                                                        DC  24
      IF (A(L,1).EQ.0.0D0) GO TO 4                                      DC  25
      B(L)=A(L,2)/A(L,1)                                                DC  26
    4 CONTINUE                                                          DC  27
C***  APPLY CORRECTIONS                                                 DC  28
      DO 5 L=1,8                                                        DC  29
      F(L)=C(L+5)                                                       DC  30
    5 C(L+5)=C(L+5)+B(L)                                                DC  31
C***  WRITE OLD AND NEW DRAG AND LIFT COEFFICIENTS AND DELTAS           DC  32
      WRITE (JWRITE,6)  (F(L),B(L),C(L+5),L=1,8)                        DC  33
    6 FORMAT (1X,///,42X,'PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPD DC  34
     1ATE',//,42X,'OLD',22X,'DELTA',22X,'NEW',//,26X,'CD0 : ',D23.16,' + DC  35
     1 ',D23.16,' = ',D23.16,/,26X,'CD1 : ',D23.16,' + ',D23.16,' = ',D2 DC  36
     13.16,/,26X,'CD2 : ',D23.16,' + ',D23.16,' = ',D23.16,/,26X,'CD3 :  DC  37
     1',D23.16,' + ',D23.16,' = ',D23.16,/,26X,'CD4 : ',D23.16,' + ',D23 DC  38
     1.16,' = ',D23.16,/,26X,'CLA0: ',D23.16,' + ',D23.16,' = ',D23.16,/ DC  39
     1,26X,'CLA : ',D23.16,' + ',D23.16,' = ',D23.16,/,26X,'CLAX: ',D23. DC  40
     116,' + ',D23.16,' = ',D23.16,///)                                 DC  41
      RETURN                                                            DC  42
      END                                                               DC  43


      SUBROUTINE SPLINE(N,Y,X,AA,IC)                                    SP   1
C                                                                       SP   2
C***  SUBROUTINE SPLINE FINDS THE RELATIONSHIP BETWEEN FUNCTION VALUES  SP   3
C***  AND ALLOWS THE CALCULATION OF DERIVATIVES                         SP   4
C***      REFERENCE FOR THIS METHOD IS:                                 SP   5
C***      THE THEORY OF SPLINES AND THEIR APPLICATIONS                  SP   6
C***      J.H. AHLBERG, ET AL, ACADEMIC PRESS, NEW YORK, 1967           SP   7
C                                                                       SP   8
      IMPLICIT REAL*8(A-H,O-Z)                                          SP   9
      DIMENSION X(N),Y(N),AA(4,N),BB(4,1827),CC(4,1827),DD(4,1827),H(182 SP  10
     17),Q(1827),U(1827),EE(4,1827)                                     SP  11
C                                                                       SP  12
      NM1=N-1                                                           SP  13
      DO 1 I=1,NM1                                                      SP  14
    1 H(I)=X(I+1)-X(I)                                                  SP  15
C***  MODIFIED LEFT-HAND END CONDITION THAT ALLEVIATES THE NEED TO       SP  16
C***  SPECIFY THE X-DERIVATIVE OF Y AT POINT 1                          SP  17
      Q(1)=-31.0D0/32.0D0                                               SP  18
      H1=H(1)                                                           SP  19
      H2=H(2)                                                           SP  20
      H3=H(3)                                                           SP  21
      U(1)=Y(1)*(32.0D0*H1+42.0D0*H2+21.0D0*H3)/(H1+H2)/(H1+H2+H3)-Y(2)* SP  22
     1(11.0D0*H1+42.0D0*H2+21.0D0*H3)/(H2+H3)/H2+Y(3)*H1*(11.0D0*H1+21.0 SP  23
     1D0*(H2+H3))/(H1+H2)/H2/H3-Y(4)*H1*(11.0D0*H1+21.0D0*H2)/(H2+H3)/(H SP  24
     11+H2+H3)/H3                                                       SP  25
C***  GENERATE INTERNAL U(I) BY ALGORITHMN GIVEN BY AHLBERG             SP  26
      U(1)=3.0D0*U(1)/H1/16.0D0                                         SP  27
      HH=H(1)                                                           SP  28
      YY=Y(2)                                                           SP  29
      YM=Y(1)                                                           SP  30
      DO 2 I=2,NM1                                                      SP  31
      HH=H(I)                                                           SP  32
      YP=Y(I+1)                                                         SP  33
      D=3.0D0*((YP-YY)/HH-(YY-YM)/HM)/(HM+HH)                           SP  34
      C=0.5D0*HH/(HH+HM)                                                SP  35
      A=0.5D0-C                                                         SP  36
      P=A*Q(I-1)+1.0D0                                                  SP  37
      Q(I)=-C/P                                                         SP  38
      U(I)=(D-A*U(I-1))/P                                               SP  39
      HM=HH                                                             SP  40
      YM=YY                                                             SP  41
    2 YY=YP                                                             SP  42
C***  MODIFIED RIGHT-HAND END CONDITION THAT ALLEVIATES THE NEED TO      SP  43
C***  SPECIFY THE X-DERIVATIVE OF Y AT POINT N                          SP  44
      A=31.0D0/32.0D0                                                   SP  45
      P=A*Q(N-1)+1.0D0                                                  SP  46
      H1=H(NM1)                                                         SP  47
      H2=H(NM1-1)                                                       SP  48
      H3=H(NM1-2)                                                       SP  49
      D=Y(N)*(32.0D0*H1+42.0D0*H2+21.0D0*H3)/(H1+H2)/(H1+H2+H3)-Y(NM1)*( SP  50
     111.0D0*H1+42.0D0*H2+21.0D0*H3)/(H2+H3)/H2+Y(NM1-1)*H1*(11.0D0*H1+2 SP  51
     11.0D0*(H2+H3))/(H1+H2)/H2/H3-Y(NM1-2)*H1*(11.0D0*H1+21.0D0*H2)/(H2 SP  52
     1+H3)/(H1+H2+H3)/H3                                                SP  53
      D=3.0D0*D/H1/16.0D0                                               SP  54
      U(N)=(D-A*U(N-1))/P                                               SP  55
C***  SOLVE FOR THE SPLINE COEFFICIENTS CORRESPONDING TO AHLBERG M(0) TO SP  56
C***  M(N) AND STORE THEM IN THE U(I)                                   SP  57
      DO 3 J=1,NM1                                                      SP  58
      I=N-J                                                             SP  59
    3 U(I)=Q(I)*U(I+1)+U(I)                                             SP  60
C***  FORM THE SPLINE COEFFICIENTS FOR THE CONVENTIONAL FORM OF A CUBIC  SP  61
C***  POLYNOMIAL FROM THE U(I)                                          SP  62
      UU=U(1)                                                           SP  63
      XX=X(1)                                                           SP  64
      YY=Y(1)                                                           SP  65
      DO 4 I=1,NM1                                                      SP  66
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```
      UP=U(I+1)                                                          SP   67
      XP=X(I+1)                                                          SP   68
      YP=Y(I+1)                                                          SP   69
      HH=H(I)                                                            SP   70
      AA(1,I)=(UP-UU)/HH/6.0D0                                           SP   71
      AA(2,I)=0.5D0*(XP*UU-XX*UP)/HH                                     SP   72
      AA(3,I)=0.5D0*(UP*XX*XX-UU*XP*XP)/HH+(UU-UP)*HH/6.0D0*(YP-YY)/HH   SP   73
      AA(4,I)=(UU*XP*XP*XP-UP*XX*XX*XX)/HH/6.0D0+(UP*XX-UU*XP)*HH/6.0D0* SP   74
     1(YY*XP-YP*XX)/HH                                                   SP   75
      XX=XP                                                              SP   76
      UU=UP                                                              SP   77
    4 YY=YP                                                              SP   78
      IF (IC.EQ.0) GO TO 13                                              SP   79
C***  STORE COEFFICIENTS FOR LATTER USE                                  SP   80
      GO TO (5,7,9,11),IC                                                SP   81
    5 DO 6 I=1,NM1                                                       SP   82
      DO 6 J1=1,4                                                        SP   83
    6 BB(J1,I)=AA(J1,I)                                                  SP   84
      GO TO 13                                                           SP   85
    7 DO 8 I=1,NM1                                                       SP   86
      DO 8 J1=1,4                                                        SP   87
    8 CC(J1,I)=AA(J1,I)                                                  SP   88
      GO TO 13                                                           SP   89
    9 DO 10 I=1,NM1                                                      SP   90
      DO 10 J1=1,4                                                       SP   91
   10 DD(J1,I)=AA(J1,I)                                                  SP   92
      GO TO 13                                                           SP   93
   11 DO 12 I=1,NM1                                                      SP   94
      DO 12 J1=1,4                                                       SP   95
   12 EE(J1,I)=AA(J1,I)                                                  SP   96
   13 RETURN                                                             SP   97
C                                                                        SP   98
      ENTRY VXX(T,Z)                                                     SP   99
C***  DETERMINE AIRSPEED AT TIME T                                       SP  100
      IF (T.GT.X(1)) GO TO 14                                            SP  101
      I=1                                                                SP  102
      GO TO 16                                                           SP  103
   14 DO 15 I=1,NM1                                                      SP  104
      IF (X(I).LE.T.AND.X(I+1).GT.T) GO TO 16                            SP  105
   15 CONTINUE                                                           SP  106
      I=NM1                                                              SP  107
   16 Z=((BB(1,I)*T+BB(2,I))*T+BB(3,I))*T+BB(4,I)                        SP  108
      RETURN                                                             SP  109
C                                                                        SP  110
      ENTRY DVX(T,Z)                                                     SP  111
C***  DETERMINE ACCELERATION AT TIME T                                   SP  112
      IF (T.GT.X(1)) GO TO 17                                            SP  113
      I=1                                                                SP  114
      GO TO 19                                                           SP  115
   17 DO 18 I=1,NM1                                                      SP  116
      IF (X(I).LE.T.AND.X(I+1).GT.T) GO TO 19                            SP  117
   18 CONTINUE                                                           SP  118
      I=NM1                                                              SP  119
   19 Z=((CC(1,I)*T+CC(2,I))*T+CC(3,I))*T+CC(4,I)                        SP  120
      RETURN                                                             SP  121
C                                                                        SP  122
      ENTRY DDVXX(T,Z)                                                   SP  123
C***  DETERMINE 2ND AIRSPEED DERIVATIVE AT TIME T                        SP  124
      IF (T.GT.X(1)) GO TO 20                                            SP  125
      I=1                                                                SP  126
      GO TO 22                                                           SP  127
   20 DO 21 I=1,NM1                                                      SP  128
      IF (X(I).LE.T.AND.X(I+1).GT.T) GO TO 22                            SP  129
   21 CONTINUE                                                           SP  130
      I=NM1                                                              SP  131
   22 Z=3.0D0*CC(1,I)*T**2+2.0D0*CC(2,I)*T+CC(3,I)                       SP  132
      RETURN                                                             SP  133
C                                                                        SP  134
      ENTRY AXX(T,Z)                                                     SP  135
C***  DETERMINE ANGLE OF ATTACK AT TIME T                                SP  136
      IF (T.GT.X(1)) GO TO 23                                            SP  137
      I=1                                                                SP  138
      GO TO 25                                                           SP  139
   23 DO 24 I=1,NM1                                                      SP  140
      IF (X(I).LE.T.AND.X(I+1).GT.T) GO TO 25                            SP  141
   24 CONTINUE                                                           SP  142
      I=NM1                                                              SP  143
   25 Z=((DD(1,I)*T+DD(2,I))*T+DD(3,I))*T+DD(4,I)                        SP  144
      RETURN                                                             SP  145
C                                                                        SP  146
      ENTRY DDDVX(T,Z)                                                   SP  147
C***  DETERMINE 3RD AIRSPEED DERIVATIVE                                  SP  148
      IF (T.GT.X(1)) GO TO 26                                            SP  149
      I=1                                                                SP  150
      GO TO 28                                                           SP  151
   26 DO 27 I=1,NM1                                                      SP  152
      IF (X(I).LE.T.AND.X(I+1).GT.T) GO TO 28                            SP  153
   27 CONTINUE                                                           SP  154
      I=NM1                                                              SP  155
   28 Z=3.0D0*EE(1,I)*T**2+2.0D0*EE(2,I)*T+EE(3,I)                       SP  156
      RETURN                                                             SP  157
      END                                                                SP  158
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      SUBROUTINE FNI(K,F,X,FP,FPP,ND,NS,NI,IC)                           FN    1
C                                                                        FN    2
C***  SUBROUTINE FNI USES NEWTON'S INTERPOLATION FORMULA TO COMPUTE       FN    3
C***  ADDITIONAL POINTS FOR CUBIC SPLINE ANALYSIS                        FN    4
C                                                                        FN    5
      IMPLICIT REAL*8(A-H,O-Z)                                           FN    6
      DIMENSION F(K),X(K),FP(K),FPP(K),XY(1827),Y(1827),AA(4,1827),FPS(1 FN    7
     1827)                                                               FN    8
C                                                                        FN    9
C***  THE ARRAYS ARE PROTECTED AGAINST 'OVERFLOW' BY THE FOLLOWING CARDS FN   10
      NB=K*(K-1)*NI+2*NS                                                 FN   11
      IF (NB.EQ.K) GO TO 4                                               FN   12
      IF (NB.LE.1827) GO TO 1                                            FN   13
      NI=3                                                               FN   14
      NS=15                                                              FN   15
      NB=K*(K-1)*NI+2*NS                                                 FN   16
C***  INITIALIZE PARAMETERS                                              FN   17
    1 DF=1.0D-12                                                         FN   18
      H=X(2)-X(1)                                                        FN   19
      XX=-H                                                              FN   20
      XC=DABS(XX/(NS+1))                                                 FN   21
      XXH=DABS(XX)+X(K)                                                  FN   22
      XCH=XC                                                             FN   23
      N=0                                                                FN   24
      L=1                                                                FN   25
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      J=6
    2 M=M+1                                                              FN   26
C***  DETERMINE THE INTERVAL IN QUESTION                                 FN   27
      XX=XX+XC                                                           FN   28
      IF (DABS(XX-XXH).LT.DF) XX=XXH                                     FN   29
      IF (XX.GE.XXH) GO TO 3                                             FN   30
      IF (DABS(XX-X(L)).LT.DF) XX=X(L)                                   FN   31
      IF (DABS(XX-X(L+1)).LT.DF) XX=X(L+1)                               FN   32
      IF (XX.EQ.X(L+1).AND.XX.LT.X(K)) L=L+1                             FN   33
      IF (DABS(XX-X(J-2)).LT.DF) XX=X(J-2)                               FN   34
      IF (XX.EQ.X(J-2).AND.J.LT.K) J=J+1                                 FN   35
C***  COMPUTE THE NEWTONIAN COEFFICIENTS                                 FN   36
      A0=F(J-5)                                                          FN   37
      A1=(F(J-4)-F(J-5))/(X(J-4)-X(J-5))                                 FN   38
      A2=(F(J-3)-(A0+A1*(X(J-3)-X(J-5))))/((X(J-3)-X(J-5))*(X(J-3)-X(J-4 FN   39
     1))))                                                               FN   40
      A3=(F(J-2)-(A0+A1*(X(J-2)-X(J-5))+A2*(X(J-2)-X(J-5))*(X(J-2)-X(J-4 FN   41
     1))))/((X(J-2)-X(J-5))*(X(J-2)-X(J-4))*(X(J-2)-X(J-3)))             FN   42
      A4=(F(J-1)-(A0+A1*(X(J-1)-X(J-5))+A2*(X(J-1)-X(J-5))*(X(J-1)-X(J-4 FN   43
     1))+A3*(X(J-1)-X(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3)))/((X(J-1)-X FN   44
     1(J-5))*(X(J-1)-X(J-4))*(X(J-1)-X(J-3))*(X(J-1)-X(J-2)))            FN   45
      A5=(F(J)-(A0+A1*(X(J)-X(J-5))+A2*(X(J)-X(J-5))*(X(J)-X(J-4))+A3*(X FN   46
     1(J)-X(J-5))*(X(J)-X(J-4))*(X(J)-X(J-3))+A4*(X(J)-X(J-5))*(X(J)-X(J FN   47
     1-4))*(X(J)-X(J-3))*(X(J)-X(J-2))))/((X(J)-X(J-5))*(X(J)-X(J-4))*(X FN   48
     1(J)-X(J-3))*(X(J)-X(J-2))*(X(J)-X(J-1)))                           FN   49
C***  COMPUTE ADDITIONAL POINTS BY INTERPOLATION                         FN   50
      Y(M)=A0+A1*(XX-X(J-5))+A2*(XX-X(J-5))*(XX-X(J-4))+A3*(XX-X(J-5))*( FN   51
     1XX-X(J-4))*(XX-X(J-3))+A4*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX- FN   52
     1X(J-2))+A5*(XX-X(J-5))*(XX-X(J-4))*(XX-X(J-3))*(XX-X(J-2))*(XX-X(J FN   53
     1-1))                                                               FN   54
      XY(M)=XX                                                           FN   55
C***  DETERMINE INTERVAL INCREMENT                                       FN   56
      IF (XX.GE.X(1).AND.XX.LT.X(K)) XC=(X(L+1)-X(L))/(NI+1)             FN   57
      IF (XX.GE.X(K)) XC=XCH                                             FN   58
      GO TO 2                                                            FN   59
    3 KN=M-1                                                             FN   60
    4 IF (NO.EQ.K) KN=K                                                  FN   61
C***  COMPUTE SPLINE COEFFICIENTS                                        FN   62
      CALL SPLINE(KN,Y,XY,AA,IC)                                         FN   63
      IF (IC.NE.0) GO TO 9                                               FN   64
C***  COMPUTE FIRST DERIVATIVE BY DIFFERENTIATION OF SPLINE FIT          FN   65
      L1=NS+1                                                            FN   66
      L2=KN-NS                                                           FN   67
      L3=NI+1                                                            FN   68
      II=0                                                               FN   69
      DO 5 I=L1,L2,L3                                                    FN   70
      II=II+1                                                            FN   71
      J=I                                                                FN   72
      IF (I.EQ.L2) J=J-1                                                 FN   73
      FP(II)=3.0D0*AA(1,J)*XY(I)**2+2.0D0*AA(2,J)*XY(I)+AA(3,J)          FN   74
    5 CONTINUE                                                           FN   75
C***  CHECK FOR SECOND DERIVATIVE REQUEST                                FN   76
      IF (NO.EQ.2) GO TO 6                                               FN   77
      GO TO 9                                                            FN   78
C***  COMPUTE ALL FIRST DERIVATIVES FOR SPLINE FIT                       FN   79
    6 DO 7 I=1,KN                                                        FN   80
      J=I                                                                FN   81
      IF (I.EQ.KN) J=J-1                                                 FN   82
    7 FPS(I)=3.0D0*AA(1,J)*XY(I)**2+2.0D0*AA(2,J)*XY(I)+AA(3,J)          FN   83
C***  COMPUTE SECOND DERIVATIVE BY DIFFERENTIATION OF SPLINED FIRST      FN   84
C***  DERIVATIVE                                                         FN   85
      CALL SPLINE(KN,FPS,XY,AA,IC)                                       FN   86
      II=0                                                               FN   87
      DO 8 I=L1,L2,L3                                                    FN   88
      II=II+1                                                            FN   89
      J=I                                                                FN   90
      IF (I.EQ.L2) J=J-1                                                 FN   91
      FPP(II)=3.0D0*AA(1,J)*XY(I)**2+2.0D0*AA(2,J)*XY(I)+AA(3,J)         FN   92
    8 CONTINUE                                                           FN   93
    9 RETURN                                                             FN   94
      END                                                                FN   95
                                                                         FN   96


      FUNCTION VA(T)
C                                                                        VA    1
C***  FUNCTION VA (WITH SPLINE) DETERMINES THE AIRSPEED AT TIME T        VA    2
C                                                                        VA    3
      IMPLICIT REAL*8(A-H,O-Z)                                           VA    4
C                                                                        VA    5
      CALL VXX(T,X)                                                      VA    6
      VA=X                                                               VA    7
      RETURN                                                             VA    8
      END                                                                VA    9
                                                                         VA   10


      FUNCTION DDV(T)
C                                                                        V2    1
C***  FUNCTION DDV (WITH SPLINE) DETERMINES THE SECOND DERIVATIVE OF     V2    2
C***  AIRSPEED AT TIME T                                                 V2    3
C                                                                        V2    4
      IMPLICIT REAL*8(A-H,O-Z)                                           V2    5
C                                                                        V2    6
      CALL DDVXX(T,X)                                                    V2    7
      DDV=X                                                              V2    8
      RETURN                                                             V2    9
      END                                                                V2   10
                                                                         V2   11


      FUNCTION DDDV(T)
C                                                                        V3    1
C***  FUNCTION DDDV (WITH SPLINE) DETERMINES THE THIRD DERIVATIVE OF     V3    2
C***  AIRSPEED AT TIME T                                                 V3    3
C                                                                        V3    4
      IMPLICIT REAL*8(A-H,O-Z)                                           V3    5
C                                                                        V3    6
      CALL DDDVX(T,X)                                                    V3    7
      DDDV=X                                                             V3    8
      RETURN                                                             V3    9
      END                                                                V3   10
                                                                         V3   11


      FUNCTION ALP(T)
C                                                                        AA    1
C***  FUNCTION ALP (WITH SPLINE) DETERMINES THE ANGLE OF ATTACK AT       AA    2
C***  TIME T                                                             AA    3
C                                                                        AA    4
                                                                         AA    5
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      IMPLICIT REAL*8(A-H,O-Z)                                          AA   6
C                                                                       AA   7
      CALL AXX(T,X)                                                     AA   8
      ALP=X                                                             AA   9
      RETURN                                                            AA  10
      END                                                               AA  11



      FUNCTION DVA(T)
C                                                                       DV   1
C***  FUNCTION DVA (WITH SPLINE) DETERMINES THE FIRST DERIVATIVE OF     DV   2
C***  AIRSPEED                                                          DV   3
C                                                                       DV   4
      IMPLICIT REAL*8(A-H,O-Z)                                          DV   5
C                                                                       DV   6
      CALL DVX(T,X)                                                     DV   7
      DVA=X                                                             DV   8
      RETURN                                                            DV   9
      END                                                               DV  10
                                                                        DV  11



      SUBROUTINE FF(T,YY,DYY,F,IPRM,DGAM,AF,IKP)
C                                                                       FF   1
C***  SUBROUTINE FF COMPUTES THE DERIVATIVE OF THE FLIGHT PATH ANGLE    FF   2
C                                                                       FF   3
      IMPLICIT REAL*8(A-H,O-Z)                                          FF   4
      EXTERNAL VA,DDV,DDDV,ALP,DVA,PHIDER                               FF   5
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F FF   6
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(45 FF   7
     1),C(450,11),X(450,1),WKAR(250),CFM(14),SGM(4),SGD(4),FT1(450),FT2( FF   8
     1450),PHRA(450),CL(450),SS(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S FF   9
     1,RHO,TIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IPX1,IEX FF  10
     12,IEX3,IEX4,METRIC,L1,L2,IEQMN(18),IERR                           FF  11
      COMMON /LAB7/A,H,W,R1                                             FF  12
      COMMON /LAB4/XRHO                                                 FF  13
      COMMON /LAB5/GMX,DGMX,D2GM,D3GM                                   FF  14
      COMMON /LAB6/T1,ADT                                               FF  15
C                                                                       FF  16
C***  SET PARAMETERS FOR ESTIMATIONS                                    FF  17
      FTR=0.26D0                                                        FF  18
      IF (IPRM.EQ.0)CDL=0.0D0                                           FF  19
      V=VA(T)                                                           FF  20
C***  COMPUTE POWER                                                     FF  21
      P=CFM(1)*CFM(2)*V**EX1+CFM(3)*V**EX2+CFM(4)*V**EX3+CFM(5)*V**EX4  FF  22
C***  STORE VALUES TEMPORARILY                                          FF  23
      WXX=W                                                             FF  24
      AXX=A                                                             FF  25
      RXX=R                                                             FF  26
      H=R1                                                              FF  27
      DVX=DVA(T)                                                        FF  28
C***  CHECK FOR INITIAL TIME POINT                                      FF  29
      IF (T1.EQ.0.0D0) GO TO 1                                          FF  30
C***  COMPUTE AIRSPEED AND ACCELERATION AT PREVIOUS TIME POINT          FF  31
      Z=T1                                                              FF  32
      V=VA(Z)                                                           FF  33
      DV=DVA(Z)                                                         FF  34
      V2=DDV(Z)                                                         FF  35
      V3=DDDV(Z)                                                        FF  36
                                                                        FF  37
C***  COMPUTE DERIVATIVES AT PREVIOUS TIME POINT                        FF  38
      DH=V*DSIN(GMX)                                                    FF  39
      D2H=DV*DSIN(GMX)+DGMX*V*DCOS(GMX)                                 FF  40
      D3H=(V2-V*DGMX*DGMX)*DSIN(GMX)+(2.0D0*DV*DGMX+V*D2GM)*DCOS(GMX)   FF  41
      D4H=(V3-3.0D0*V*DGMX*D2GM-3.0D0*DV*DGMX**2)*DSIN(GMX)+(3.0D0*V2*DG FF  42
     1MX-V*DGMX**3+3.0D0*DV*D2GM+V*D3GM)*DCOS(GMX)                      FF  43
      IF (D3GM.EQ.0.0D0) D4H=0.0D0                                      FF  44
      TMT1=T-T1                                                         FF  45
C***  ESTIMATE ALTITUDE                                                 FF  46
      H=H+TMT1*(DH+TMT1*(D2H/2.0D0+TMT1*(D3H/6.0D0+TMT1*D4H/24.0D0)))   FF  47
C***  ESTIMATE DENSITY                                                  FF  48
      R2=RHO*(1.0D0-6.86D-6*H)**4.26D0                                  FF  49
      RNET=R2-R                                                         FF  50
C***  COMPUTE POWER AT PREVIOUS TIME POINT                              FF  51
      PX=CFM(1)*CFM(2)*V**EX1+CFM(3)*V**EX2+CFM(4)*V**EX3+CFM(5)*V**EX4 FF  52
C***  DETERMINE WEIGHT DERIVATIVES AT PREVIOUS TIME POINT               FF  53
      DW=-F*PX                                                          FF  54
      D2W=-F*DV*(EX1*CFM(2)*V**(EX1-1.0D0)+EX2*CFM(3)*V**(EX2-1.0D0)+EX3 FF  55
     1*CFM(4)*V**(EX3-1.0D0)+EX4*CFM(5)*V**(EX4-1.0D0))                 FF  56
      D3W=-F*(DV**2*(EX1*CFM(2)*(EX1-1.0D0)*V**(EX1-2.0D0)+EX2*CFM(3)*(E FF  57
     1X2-1.0D0)*V**(EX2-2.0D0)+EX3*CFM(4)*(EX3-1.0D0)*V**(EX3-2.0D0)+EX4 FF  58
     1*CFM(5)*(EX4-1.0D0)*V**(EX4-2.0D0))+V2*(EX1*CFM(2)*V**(EX1-1.0D0)+ FF  59
     1EX2*CFM(3)*V**(EX2-1.0D0)+EX3*CFM(4)*V**(EX3-1.0D0)+EX4*CFM(5)*V** FF  60
     1(EX4-1.0D0)))                                                     FF  61
      D4W=-F*((EX1*CFM(2)*(EX1-1.0D0)*(EX1-2.0D0)*V**(EX1-3.0D0)+EX2*CFM FF  62
     1(3)*(EX2-1.0D0)*(EX2-2.0D0)*V**(EX2-3.0D0)+EX3*CFM(4)*(EX3-1.0D0)* FF  63
     1(EX3-2.0D0)*V**(EX3-3.0D0)+EX4*CFM(5)*(EX4-1.0D0)*(EX4-2.0D0)*V**( FF  64
     1EX4-3.0D0))*DV**3+3.0D0*DV*V2*(EX1*CFM(2)*(EX1-1.0D0)*V**(EX1-2.0D FF  65
     10)*EX2*CFM(3)*(EX2-1.0D0)*V**(EX2-2.0D0)+EX3*CFM(4)*(EX3-1.0D0)*V* FF  66
     1*(EX3-2.0D0)+EX4*CFM(5)*(EX4-1.0D0)*V*(EX4-2.0D0))+V3*(EX1*CFM(2)* FF  67
     1V**(EX1-1.0D0)+EX2*CFM(3)*V**(EX2-1.0D0)+EX3*CFM(4)*V**(EX3-1.0D0) FF  68
     1+EX4*CFM(5)*V**(EX4-1.0D0)))                                      FF  69
C***  ESTIMATE ANGLE OF ATTACK                                          FF  70
      AX=A+AF*FTR*ADT*TMT1                                              FF  71
      IF (IPRM.NE.0) AX=A+AF*FTR*ADT*TMT1+AF*CDL                        FF  72
C***  ESTIMATE WEIGHT                                                   FF  73
      WX=W+AF*(TMT1*(DW+TMT1*(D2W/2.0D0+TMT1*(D3W/6.0D0+TMT1*D4W/24.0D0) FF  74
     1))                                                                FF  75
C***  ESTIMATE DENSITY                                                  FF  76
      RX=R+AF*RNET                                                      FF  77
      A=AX                                                              FF  78
      W=WX                                                              FF  79
      R=RX                                                              FF  80
      GO TO 2                                                           FF  81
    1 A=AXX                                                             FF  82
      W=WXX                                                             FF  83
      R=RXX                                                             FF  84
C***  COMPUTE DRAG COEFFICIENT                                          FF  85
    2 AM=DABS(A)                                                        FF  86
      IF (A.LT.0.0D0) CALL SIGNS(SGM,IEX1,IEX2,IEX3,IEX4)               FF  87
      CD=CFM(6)+SGM(1)*CFM(7)*AM**IEX1+SGM(2)*CFM(8)*AM**IEX2*SGM(3)*CFM FF  88
     1(9)*AM**IEX3+SGM(4)*CFM(10)*AM**IEX4                              FF  89
      IF (A.LT.0.0D0) CALL CHNGE(SGM)                                   FF  90
C***  ESTIMATE A FLIGHT PATH ANGLE FROM THE EQUATION OF MOTION          FF  91
      ARG=P*DCOS(A)/(W*V)-R*S*V*V*CD/(2.0D0*W)-DVX/G                    FF  92
      DARG=-(P*DSIN(A)/(W*V)+R*S*V*V/(2.0D0*W))*(IEX1*CFM(7)*A**(IEX1-1)+ FF  93
     1IEX2*CFM(8)*A**(IEX2-1)+IEX3*CFM(9)*A**(IEX3-1)+IEX4*CFM(10)*A**(I FF  94
     1EX4-1)))                                                          FF  95
      GAM1=DARSIN(ARG)                                                  FF  96
      DGDA=DARG/(DSQRT(1.0D0-ARG*ARG))                                  FF  97
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C***  DETERMINE DIFFERENCE IN 'PREDICTED' AND ABOVE ESTIMATION OF FLIGHT  FF   98
C***  PATH ANGLE                                                          FF   99
      DGAM=YY-GAM1                                                        FF  100
C***  DETERMINE A CORRECTION TO ANGLE OF ATTACK THRU DERIVATIVES OF       FF  101
C***  EQUATION OF MOTION                                                  FF  102
      IF (IKP.EQ.0) GO TO 3                                               FF  103
      ADEL=DGAM/DGDA                                                      FF  104
      CDL=CDL+ADEL                                                        FF  105
C***  COMPUTE DERIVATIVE OF FLIGHT PATH ANGLE                             FF  106
    3 DYY=G*S*R*Y*(CFM(11)+CFM(12)*A+CFM(13)*A**EXPX)/(2.0D0*W)+G*P*DSIN  FF  107
     1(A)/(W*Y*Y)-G*DCOS(YE)/Y                                          FF  108
      XRHO=R                                                              FF  109
      A=AXX                                                               FF  110
      W=WXX                                                               FF  111
      R=RXX                                                               FF  112
      RETURN                                                              FF  113
      END                                                                 FF  114


      SUBROUTINE TREMOR(H,XX,YY,D2Y,D3Y,D4Y,ISET,F,IPRM,KK,IK)            TR    1
C                                                                         TR    2
C***  SUBROUTINE TREMOR PREDICTS A FLIGHT PATH TRAJECTORY                 TR    3
C                                                                         TR    4
      IMPLICIT REAL*8(A-H,O-Z)                                            TR    5
      EXTERNAL VA,DDV,DDDV,ALP,DVA,PHIDER                                 TR    6
      COMMON /TEST/ICKP                                                   TR    7
      COMMON /LAB3/DGAM                                                   TR    8
      COMMON /LAB6/T1,ADT                                                 TR    9
      COMMON /PCR/DY(7),X(7),Y(7)                                         TR   10
      COMMON /LABX/JWRITE,IR                                              TR   11
      COMMON /CRCOEF/P,A0,A1,A2,A3,A4,A5,HH                               TR   12
C                                                                         TR   13
C***  INITIALIZE PARAMETERS                                               TR   14
      AF=0.0D0                                                            TR   15
      IKP=0                                                               TR   16
C***  COMPUTE DERIVATIVE AT BEGINNING OF INTERVAL                         TR   17
      CALL FF(XX,YY,D2Y,F,IPRM,DGAM,AF,IKP)                               TR   18
      DY(7)=D2Y                                                           TR   19
      T1=XX                                                               TR   20
C***  TEST FOR INITIALIZATION                                             TR   21
      IF (ISET)  1,1,3                                                    TR   22
C***  INITIALIZE PARAMETERS                                               TR   23
    1 DO 2 I=1,7                                                          TR   24
      X(I)=YY                                                             TR   25
      DY(I)=D2Y                                                           TR   26
    2 X(I)=XX                                                             TR   27
C***  BEGIN RUNGE KUTTA                                                   TR   28
      LK=6                                                                TR   29
      K=1                                                                 TR   30
      ISET=1                                                              TR   31
      GO TO 4                                                             TR   32
    3 IF (K.LT.7)K=K+1                                                    TR   33
      IF (K-7)  4,7,7                                                     TR   34
C***  DEFINE VARIABLES FOR FF                                             TR   35
    4 Y2=YY+0.5D0*H*D2Y                                                   TR   36
      AF=0.5D0                                                            TR   37
      IKP=0                                                               TR   38
C***  COMPUTE DERIVATIVE AT INTERVAL MIDPOINT                             TR   39
      CALL FF(XX+0.5D0*H,Y2,DY2,F,IPRM,DGAM,AF,IKP)                       TR   40
      Y3=YY+0.5D0*H*DY2                                                   TR   41
C***  UPDATE DERIVATIVE AT INTERVAL MIDPOINT                              TR   42
      CALL FF(XX+0.5D0*H,Y3,DY3,F,IPRM,DGAM,AF,IKP)                       TR   43
C***  APPLY CORRECTIVE PROCEDURE FOR RUNGE KUTTA                          TR   44
      IF (DABS(DY2-D2Y).LT.1.0D-15) GO TO 5                               TR   45
      P=-2.0D0*(DY3-DY2)/(DY2-D2Y)/H                                      TR   46
      IF ((P*H).LT.1.0D-04) GO TO 5                                       TR   47
C***  COMPUTE 'STIFF-EQUATION' F COEFFICIENTS                             TR   48
      F0=0.0D0                                                            TR   49
      IF ((-P*H).LT.174.673D0.AND.(-P*H).GT.-180.218D0)F0=DEXP(-P*H)      TR   50
      F1=-(F0-1.0D0)/P/H                                                  TR   51
      F2=-(F1-1.0D0)/P/H                                                  TR   52
      F3=-(F2-0.5D0)/P/H                                                  TR   53
      Y4=YY+H*(2.0D0*DY3*F2+D2Y*(F1-2.0D0*F2)+DY2*P*H*F2)                 TR   54
      AF=1.0D0                                                            TR   55
      IKP=0                                                               TR   56
      GO TO 6                                                             TR   57
C***  SET F COEFFICIENTS TO STANDARD ADAMS-BASHFORTH F COEFFICIENTS       TR   58
    5 F1=1.0D0                                                            TR   59
      F2=0.5DC                                                            TR   60
      F3=1.6666666666666667D-1                                            TR   61
      P=0.0D0                                                             TR   62
      Y4=YY+H*DY3                                                         TR   63
      AF=1.0D0                                                            TR   64
      IKP=0                                                               TR   65
C***  COMPUTE DERIVATIVE AT END OF INTERVAL                               TR   66
    6 CALL FF(XX+H,Y4,DY4,F,IPRM,DGAM,AF,IKP)                             TR   67
      B=-3.0D0*(D2Y+P*YY)+2.0D0*(DY2+P*Y2)+2.0D0*(DY3+P*Y3)-(DY4+P*Y4)    TR   68
      C=4.0D0*((D2Y+P*YY)-(DY2+P*Y2)-(DY3+P*Y3)+(DY4+P*Y4))               TR   69
      YR=YY+H*(D2Y*F1+B*F2+C*F3)                                          TR   70
      IKP=1                                                               TR   71
C***  UPDATE DERIVATIVE AT END OF INTERVAL BY CORRECTOR                   TR   72
      CALL FF(XX+H,YR,DYR,F,IPRM,DGAM,AF,IKP)                             TR   73
      IKP=0                                                               TR   74
      GO TO 14                                                            TR   75
    7 IF (IPRM.NE.6) GO TO 9                                              TR   76
      DO 8 I=1,6                                                          TR   77
      Y(I)=Y(I+1)                                                         TR   78
      DY(I)=DY(I+1)                                                       TR   79
    8 X(I)=X(I+1)                                                         TR   80
      X(7)=X(6)+H                                                         TR   81
C***  CALL PREDICTOR TO PREDICT Y AT NEXT POINT                           TR   82
    9 DO 10 I=1,6                                                         TR   83
   10 CALL PHICEF(I)                                                      TR   84
      K=7                                                                 TR   85
      LK=LK+1                                                             TR   86
      PRDCT=Y(1)+PHIDER(6,X(7),-1,1,0)-PHIDER(6,X(1),-1,1,0)              TR   87
C***  USING PREDICTED Y, COMPUTE ITS DERIVATIVE                           TR   88
      AF=1.0D0                                                            TR   89
      IKP=0                                                               TR   90
      CALL FF(X(7),PRDCT,DYP,F,IPRM,DGAM,AF,IKP)                          TR   91
      DY(7)=DYP                                                           TR   92
      CALL PHICEF(7)                                                      TR   93
C***  GENERATE COEFFICIENTS NECESSARY FOR 'STIFF-EQUATION' CORRECTOR      TR   94
      CALL PCEF                                                           TR   95
C***  TEST FOR SUITABLE CORRECTOR                                         TR   96
      IF ((P*HH).LT.1.0D-02) GO TO 12                                     TR   97
      IF ((P*HH).GT.22.0D0)ICKP=ICKP+1                                    TR   98
      IF ((P*HH).GT.22.0D0) WRITE (JWRITE,11)                             TR   99
   11 FORMAT (2X,20('*'),'P*HH > 22.0')                                   TR  100
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C***  CORRECT Y BY 'STIFF-EQUATION' CORRECTOR                                TR  101
      CALL PMETH                                                             TR  102
      GO TO 13                                                               TR  103
C***  CORRECT Y BY MODIFIED TREANOR CORRECTOR                                TR  104
   12 Y(7)=Y(1)+PHIDER(7,X(7),-1,1,0)-PHIDER(7,X(1),-1,1,0)                  TR  105
   13 YR=Y(7)                                                               TR  106
C***  COMPUTE 1ST DERIVATIVE OF FLIGHT PATH ANGLE                            TR  107
      AP=1.0D0                                                               TR  108
      IKP=1                                                                  TR  109
      CALL FP(X(7),YR,DYR,P,IPRM,DGAM,AP,IKP)                                TR  110
      DY(7)=DYR                                                              TR  111
C***  COMPUTE 2ND DERIVATIVE OF FLIGHT PATH ANGLE                            TR  112
      D2Y=PHIDER(7,X(7),1,1,0)                                               TR  113
C***  COMPUTE 3RD DERIVATIVE OF FLIGHT PATH ANGLE                            TR  114
      D3Y=PHIDER(7,X(7),2,1,0)                                               TR  115
C***  TEST FOR POSSIBLE ERRORS                                               TR  116
      IF (IR.NE.0) RETURN                                                    TR  117
   14 IF (DABS(DGAM).LT.1.0D-16)KK=1                                         TR  118
      IF (IPRM.NE.IK.AND.KK.EQ.0) GO TO 18                                   TR  119
      IF (LK.EQ.7) GO TO 17                                                  TR  120
      IF (LK.GT.7) GO TO 16                                                  TR  121
      DO 15 I=1,6                                                            TR  122
      Y(I)=Y(I+1)                                                            TR  123
      DY(I)=DY(I+1)                                                          TR  124
   15 X(I)=X(I+1)                                                            TR  125
      X(7)=X(6)+H                                                            TR  126
   16 Y(7)=YR                                                                TR  127
      DY(7)=DYR                                                              TR  128
      IF (K.EQ.6) GO TO 9                                                    TR  129
   17 YY=Y(7)                                                                TR  130
      D2Y=DY(7)                                                              TR  131
      XX=X(7)                                                                TR  132
   18 RETURN                                                                 TR  133
      END                                                                    TR  134
```

```
      SUBROUTINE WSUB(N,P,TH,WW,JWRITE)                                      WS    1
                                                                             WS    2
C                                                                            WS    3
C***  SUBROUTINE WSUB FITS THE WEIGHT TIME HISTORY WITH A TRIGONOMETRIC       WS    4
C***  POLYNOMIAL AND CHECKS ITS DERIVATIVE FOR DECREASING WEIGHT             WS    5
C                                                                            WS    6
      IMPLICIT REAL*8(A-H,O-Z)                                               WS    7
      DIMENSION P(N),TH(N),WW(N),C(450,9),X(450,1),WK(250)                   WS    8
C                                                                            WS    9
C***  INITIALIZE PARAMETERS                                                  WS   10
      PI=3.14159265358979300                                                 WS   11
      TT=TH(N)                                                               WS   12
      IT=PI/TT                                                               WS   13
C***  FORM LEAST-SQUARES COEFFICIENTS                                        WS   14
      DO 1 J=1,N                                                             WS   15
      TEMP=P(J)-P(1)                                                         WS   16
      WT=1.0D0                                                               WS   17
      IF (J.EQ.1.OR.J.EQ.N)WT=WT*WT                                          WS   18
      T=TH(J)                                                                WS   19
      TX=T/TT*PI                                                             WS   20
      C(J,1)=WT*T                                                            WS   21
      C(J,2)=WT*DCOS(TX)                                                     WS   22
      C(J,3)=WT*DSIN(TX)                                                     WS   23
      C(J,4)=WT*DCOS(2.0*TX)                                                 WS   24
      C(J,5)=WT*DSIN(2.0*TX)                                                 WS   25
      C(J,6)=WT*DCOS(3.0*TX)                                                 WS   26
      C(J,7)=WT*DSIN(3.0*TX)                                                 WS   27
      C(J,8)=WT*DCOS(4.0*TX)                                                 WS   28
      C(J,9)=WT*DSIN(4.0*TX)                                                 WS   29
    1 X(J,1)=WT*TEMP                                                         WS   30
C***  EXACT LEAST SQUARES                                                    WS   31
      CALL LLSQAR(C,X,N,9,1,450,450,15,WK,IER,JWRITE)                        WS   32
      DO 2 J=1,N                                                             WS   33
      T=TH(J)                                                                WS   34
      TX=T/TT*PI                                                             WS   35
C***  COMPUTE AND CHECK WEIGHT DERIVATIVE                                    WS   36
      WD=X(1,1)-X(2,1)*XT*DSIN(TX)+X(3,1)*XT*DCOS(TX)-X(4,1)*2.0*XT*DSIN     WS   37
     1(2.0*TX)+X(5,1)*2.0*XT*DCOS(2.0*TX)-X(6,1)*3.0*XT*DSIN(3.0*TX)+X(7    WS   38
     1,1)*3.0*XT*DCOS(3.0*TX)-X(8,1)*4.0*XT*DSIN(4.0*TX)+X(9,1)*4.0*XT*D    WS   39
     1COS(4.0*TX)                                                           WS   40
      IF (WD.GE.0.0D0) GO TO 3                                               WS   41
C***  COMPUTE FITTED WEIGHT                                                  WS   42
      WX=X(1,1)*T+X(2,1)*DCOS(TX)+X(3,1)*DSIN(TX)+X(4,1)*DCOS(2.0*TX)+X(     WS   43
     15,1)*DSIN(2.0*TX)+X(6,1)*DCOS(3.0*TX)+X(7,1)*DSIN(3.0*TX)+X(8,1)*D    WS   44
     1COS(4.0*TX)+X(9,1)*DSIN(4.0*TX)                                       WS   45
      WW(J)=WX+P(1)                                                          WS   46
    2 CONTINUE                                                               WS   47
      GO TO 7                                                                WS   48
    3 WRITE (JWRITE,4)                                                       WS   49
    4 FORMAT (1X,//,10X,'WEIGHT DERIVATIVE FOUND TO BE > OR = ZERO.',//)     WS   50
C***  REDUCE POLYNOMIAL TO FIRST ORDER IF WEIGHT DERIVATIVE IS FOUND         WS   51
C***  POSITIVE                                                               WS   52
      DO 5 J=1,N                                                             WS   53
      TEMP=P(J)-P(1)                                                         WS   54
      WT=1.0D0                                                               WS   55
      IF (J.EQ.1.OR.J.EQ.N) WT=WT*WT                                         WS   56
      C(J,1)=WT*TH(J)                                                        WS   57
      C(J,2)=WT                                                              WS   58
    5 X(J,1)=WT*TEMP                                                         WS   59
      CALL LLSQAR(C,X,2,1,450,450,15,WK,IER,JWRITE)                          WS   60
      DO 6 J=1,N                                                             WS   61
    6 WW(J)=X(1,1)*TH(J)+X(2,1)*P(1)                                         WS   62
    7 RETURN                                                                 WS   63
      END
```

```
      SUBROUTINE ADJUST(C,CC,CX,X,DSCALE,LLOC,MLOC,IP,NEQ)                   AT    1
                                                                             AT    2
C                                                                            AT    3
C***  SUBROUTINE ADJUST ADJUSTS MATRICES DUE TO SUBROUTINE MPATH'S           AT    4
C***  COEFFICIENT FREEZING                                                   AT    5
C                                                                            AT    6
      IMPLICIT REAL*8(A-H,O-Z)                                               AT    7
      DIMENSION C(13,13),CC(13,1),CX(14),X(13),LLOC(13),MLOC(13),LOC(13)     AT    8
     1,D(13,13),DSCALE(13)                                                   AT    9
C                                                                            AT   10
C***  MODIFY CC-MATRIX AND DETERMINE LOCATIONS OF FROZEN COEFFICIENTS         AT   11
      M=0                                                                    AT   12
      DO 2 JXP=1,NEQ                                                         AT   13
      IF (CX(JXP).EQ.0.0D0.OR.LLOC(JXP).NE.0) GO TO 2                        AT   14
      M=M+1                                                                  AT   15
      LOC(M)=0                                                               AT   16
      IF (MLOC(JXP).EQ.0) GO TO 2                                            AT   17
      LOC(M)=1
```

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      DO 1 L=1,IP                                                       AT  18
    1 CC(L,1)=CC(L,1)-C(N,L)*X(N)*DSCALE(N)                             AT  19
    2 CONTINUE                                                          AT  20
C***  UPDATE MATRICES                                                   AT  21
      LX=0                                                              AT  22
      DO 4 I=1,IP                                                       AT  23
      IF (LOC(I).EQ.1) GO TO 4                                          AT  24
      LX=LX+1                                                           AT  25
      LN=0                                                              AT  26
      DO 3 J=1,IP                                                       AT  27
      IF (LOC(J).EQ.1) GO TO 3                                          AT  28
      LN=LN+1                                                           AT  29
      D(LX,LN)=C(I,J)                                                   AT  30
    3 CONTINUE                                                          AT  31
      CC(LX,1)=CC(I,1)                                                  AT  32
    4 CONTINUE                                                          AT  33
C***  DEFINE NEW UPDATED MATRIX                                         AT  34
      IP=LX                                                             AT  35
      DO 5 I=1,IP                                                       AT  36
      DO 5 J=1,IP                                                       AT  37
    5 C(J,I)=D(J,I)                                                     AT  38
      RETURN                                                            AT  39
      END                                                               AT  40



      SUBROUTINE PCEF                                                   PC   1
C                                                                       PC   2
C***  SUBROUTINE PCEF CALCULATES THE COEFFICIENTS FOR THE 'STIFF-       PC   3
C***  EQUATION' CORRECTOR                                               PC   4
C                                                                       PC   5
      IMPLICIT REAL*8(A-Z)                                              PC   6
      REAL*8 TOL/1.0D-2/                                                PC   7
      COMMON /PCR/DY0,DY1,DY2,DY3,DY4,DY5,DY6,X0,X1,X2,X3,X4,X5,X6,Y0,Y1 PC   8
     1,Y2,Y3,Y4,Y5,Y6                                                   PC   9
      COMMON /CRCOEF/P,A0,A1,A2,A3,A4,A5,N                              PC  10
C                                                                       PC  11
C***  DEFINE DIFFERENCES                                                PC  12
      T(1)=X-X0                                                         PC  13
      W(1)=Y-Y0                                                         PC  14
      V(DY)=DY-DY0                                                      PC  15
C***  CALCULATE X-DIFFERENCES                                           PC  16
      T0=T(X0)                                                          PC  17
      T1=T(X1)                                                          PC  18
      T2=T(X2)                                                          PC  19
      T3=T(X3)                                                          PC  20
      T4=T(X4)                                                          PC  21
      T5=T(X5)                                                          PC  22
      T6=T(X6)                                                          PC  23
C***  CALCULATE Y-DIFFERENCES RELATIVE TO Y0                            PC  24
      W0=W(Y0)                                                          PC  25
      W1=W(Y1)                                                          PC  26
      W2=W(Y2)                                                          PC  27
      W3=W(Y3)                                                          PC  28
      W4=W(Y4)                                                          PC  29
      W5=W(Y5)                                                          PC  30
      W6=W(Y6)                                                          PC  31
C***  CALCULATE DY-DIFFERENCES RELATIVE TO DY0                          PC  32
      V0=V(DY0)                                                         PC  33
      V1=V(DY1)                                                         PC  34
      V2=V(DY2)                                                         PC  35
      V3=V(DY3)                                                         PC  36
      V4=V(DY4)                                                         PC  37
      V5=V(DY5)                                                         PC  38
      V6=V(DY6)                                                         PC  39
C***  EQUATION 1                                                        PC  40
      B0=W1/T1                                                          PC  41
      B2=-T1                                                            PC  42
      B3=B2*T1                                                          PC  43
      B4=B3*T1                                                          PC  44
      B5=B4*T1                                                          PC  45
      B6=W1/T1                                                          PC  46
C***  EQUATION 2                                                        PC  47
      C0=(V2-T2*B0)/C                                                   PC  48
      C3=-(T2*(B3+T2*T2))/C                                             PC  49
      C4=-(T2*(B4+T2*T2*T2))/C                                          PC  50
      C=T2*(B2+T2)                                                      PC  51
      C5=-(T2*(B5+T2*T2*T2*T2))/C                                       PC  52
      C6=(W2-T2*B6)/C                                                   PC  53
C***  UPDATE EQUATION 2                                                 PC  54
      D0=B2*C0+B0                                                       PC  55
      D3=B2*C3+B3                                                       PC  56
      D4=B2*C4+B4                                                       PC  57
      D5=B2*C5+B5                                                       PC  58
      D6=B2*C6+B6                                                       PC  59
C***  EQUATION 3                                                        PC  60
      E=T3*(D3+T3*(C3+T3))                                              PC  61
      E0=(V3-(T3*(D0+T3*C0)))/E                                         PC  62
      E4=-(T3*(D4+T3*(C4+T3*T3)))/E                                     PC  63
      E5=-(T3*(D5+T3*(C5+T3*T3*T3)))/E                                  PC  64
      E6=(W3-T3*(D6+T3*C6))/E                                           PC  65
C***  UPDATE EQUATION 3                                                 PC  66
      F0=D3*E0+D0                                                       PC  67
      F4=D3*E4+D4                                                       PC  68
      F5=D3*E5+D5                                                       PC  69
      F6=D3*E6+D6                                                       PC  70
      G0=C3*E0+C0                                                       PC  71
      G4=C3*E4+C4                                                       PC  72
      G5=C3*E5+C5                                                       PC  73
      G6=C3*E6+C6                                                       PC  74
C***  EQUATION 4                                                        PC  75
      H=T4*(F4+T4*(G4+T4*(E4+T4)))                                      PC  76
      H0=(V4-(T4*(F0+T4*(G0+T4*E0))))/H                                 PC  77
      H5=-(T4*(F5+T4*(G5+T4*(E5+T4*T4))))/H                             PC  78
      H6=(W4-(T4*(F5+T4*(G6+T4*E6))))/H                                 PC  79
C***  UPDATE EQUATION 4                                                 PC  80
      I0=F4*H0+F0                                                       PC  81
      I5=F4*H5+F5                                                       PC  82
      I6=F4*H6+F6                                                       PC  83
      J0=G4*H0+G0                                                       PC  84
      J5=G4*H5+G5                                                       PC  85
      J6=G4*H6+G6                                                       PC  86
      K0=E4*H0+E0                                                       PC  87
      K5=E4*H5+E5                                                       PC  88
      K6=E4*H6+E6                                                       PC  89
C***  EQUATION 5                                                        PC  90
      L=T5*(I5+T5*(J5+T5*(K5+T5*(H5+T5))))                              PC  91
      L0=(V5-(T5*(I0+T5*(J0+T5*(K0+T5*H0)))))/L                         PC  92
      L6=(W5-(T5*(I6+T5*(J6+T5*(K6+T5*H6)))))/L                         PC  93
C***  UPDATE EQUATION 5                                                 PC  94
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```
      M5=I5*L0+I0                                                       PC   95
      M6=I5*L6+I6                                                       PC   96
      N0=J5*L0+J0                                                       PC   97
      N6=J5*L6+J6                                                       PC   98
      Q0=K5*L0+K0                                                       PC   99
      Q6=K5*L6+K6                                                       PC  100
      R0=M5*L0+N0                                                       PC  101
      R6=M5*L6+N6                                                       PC  102
      H=X6-X0                                                           PC  103
      P=(T6*(R6+T6*(N6+T6*(Q6+T6*(R6+T6*L6)))))-M6)                     PC  104
      IF (DABS(P).LT.1.0D-33) P=1.0D-33                                 PC  105
      XNM=-(T6*(R0+T6*(N0+T6*(Q0+T6*(R0+T6*L0)))))-V6)                  PC  106
      IF (DABS(XNM).LT.1.0D-33) XNM=1.0-33                              PC  107
C***  CHECK EXPONENTS TO PREVENT UNDERFLOWS AND OVERFLOWS               PC  108
      TEXP=DLOG(DABS(XNM))-DLOG(DABS(P))                                PC  109
      IF (TEXP.LT.-77.0D0) GO TO 5                                      PC  110
      IF (TEXP.LE.74.0D0) GO TO 1                                       PC  111
      IX1=-1.0D0                                                        PC  112
      IX2=-1.0D0                                                        PC  113
      IF (DABS(XNM).EQ.XNM) IX1=1.0D0                                   PC  114
      IF (DABS(P).EQ.P) IX2=1.0D0                                       PC  115
      IXS=IX1*IX2                                                       PC  116
      P=-1.0D+74                                                        PC  117
      IF (IXS.GT.0.0D0) P=1.0D+74                                       PC  118
      IF (P.LT.0.0D0) GO TO 5                                           PC  119
      GO TO 2                                                           PC  120
C***  CALCULATE COEFFICIENTS                                            PC  121
    1 P=XNM/P                                                           PC  122
C***  TEST FOR MACHINE LIMIT                                            PC  123
    2 IF ((P*H).LT.22.0D0) GO TO 3                                      PC  124
      P=22.0D0/H                                                        PC  125
    3 IF (P.LT.TOL) GO TO 5                                             PC  126
      A0=DY0                                                            PC  127
      A1=R0+P*R6                                                        PC  128
      A2=N0+P*N6                                                        PC  129
      A3=Q0+P*Q6                                                        PC  130
      A4=R0+P*R6                                                        PC  131
      A5=L0+P*L6                                                        PC  132
    4 RETURN                                                            PC  133
    5 P=0D0                                                             PC  134
      GO TO 4                                                           PC  135
      END                                                               PC  136


      SUBROUTINE PHICEP(I)
C                                                                       CP   1
C***  SUBROUTINE PHICEP COMPUTES COEFFICIENTS FOR NEWTON'S FORWARD      CP   2
C***  INTERPOLATION SCHEME FOR NON-EQUIDISTANT INTERVALS FOR THE        CP   3
C***  FOLLOWING FUNCTION PHI:                                           CP   4
C***    PHI(X)=A(1)+A(2)*(X-X(1))+A(3)*(X-X(1))*(X-X(2))+...           CP   5
C***                 ...+A(I)*(X-X(1))*(X-X(2))*...*(X-X(I-1))+...     CP   6
C***                 ...+A(N)*(X-X(1))*(X-X(2))*...*(X-X(N-1)).       CP   7
C***  BY USING A RECURSION FORMULA, PHICEP CAN BE USED TO COMPUTE BOTH  CP   8
C***  DERIVATIVES AND ANTIDERIVATIVES OF PHI.  PHICEP MUST BE CALLED IN CP   9
C***  CONSECUTIVELY-INCREASING VALUES OF I FOR THE RECURSION FORMULA TO CP  10
C***  BE CORRECT.                                                       CP  11
C                                                                       CP  12
      IMPLICIT REAL*8(A-H,O-Z)                                          CP  13
      COMMON /AWRK/A(7),C(7,8)                                          CP  14
      COMMON /PCB/F(7),X(7),Y(7)                                        CP  15
      COMMON /LABX/JWRITE,IERR                                          CP  16
C                                                                       CP  17
      IF (I.LT.1.OR.I.GT.7) GO TO 8                                     CP  18
C***  TRANSLATE                                                         CP  19
      SVE=X(1)                                                          CP  20
      DO 1 J=1,I                                                        CP  21
    1 X(J)=X(J)-SVE                                                     CP  22
C***  CALCULATE THE C-COEFFICIENTS                                      CP  23
      J=1                                                               CP  24
C***  NOTE: C(I,1)=1 FOR ALL I                                          CP  25
      C(I,J)=1D0                                                        CP  26
    2 J=J+1                                                             CP  27
      IF (J.GT.I) GO TO 3                                               CP  28
      C(I,J)=X(I-1)*C(I-1,J-1)+C(I-1,J)                                 CP  29
      GO TO 2                                                           CP  30
C***  NOTE: C(I,I+1)=0 FOR ALL I                                        CP  31
    3 C(I,I+1)=0D0                                                      CP  32
C***  CALCULATE A(I)                                                    CP  33
      A(I)=0D0                                                          CP  34
      DNM=1D0                                                           CP  35
      J=1                                                               CP  36
    4 IF (J.GT.I-1) GO TO 5                                             CP  37
      A(I)=A(I)+A(J)*DNM                                                CP  38
      DNM=DNM*(X(I)-X(J))                                               CP  39
      J=J+1                                                             CP  40
      GO TO 4                                                           CP  41
    5 A(I)=(F(I)-A(I))/DNM                                              CP  42
C***  RESET                                                             CP  43
      DO 6 J=1,I                                                        CP  44
    6 X(J)=X(J)+SVE                                                     CP  45
    7 RETURN                                                            CP  46
    8 IERR=1                                                            CP  47
      WRITE (JWRITE,9) I                                                CP  48
    9 FORMAT (1H ,'***PHICEP ERROR: I=',I3,' BUT 0<I<8 IS REQUIRED***') CP  49
      GO TO 7                                                           CP  50
      END                                                               CP  51
                                                                        CP  52


      FUNCTION PHIDER(N,XX,K,ICF1,ICF2)
C                                                                       PD   1
C***  FUNCTION PHIDER IS CAPABLE OF COMPUTING THE DERIVATIVE AND/OR     PD   2
C***  ANTIDERIVATIVE OF PHI (AS DESCRIBED IN SUBROUTINE PHICEP).  IT    PD   3
C***  SHOULD BE NOTED THAT                                              PD   4
C***  N  DEFINES THE NUMBER OF TERMS OF PHI TO USE OR THE NUMBER OF     PD   5
C***  TERMS THAT ARE AVAILABLE TO USE                                   PD   6
C***  XX DEFINES THE VALUE OF X AT WHICH TO CALCULATE THE DERIVATIVE OR PD   7
C***  ANTIDERIVATIVE                                                    PD   8
C***  K SPECIFIES THE DERIVATIVE TO    CALCULATE: K MAY BE ANY INTEGER  PD   9
C***  SUCH THAT POSITIVE (DERIVATIVES), ZERO (PHI), NEGATIVE (ANTIDERI- PD  10
C***  VATIVES)).                                                        PD  11
C                                                                       PD  12
      IMPLICIT REAL*8(A-H,O-Z)                                          PD  13
      DIMENSION DFACT(13)                                               PD  14
      COMMON /AWRK/A(7),C(7,8)                                          PD  15
      COMMON /LABX/JWRITE,IERR                                          PD  16
      COMMON /PCB/F(7),X(7),Y(7)                                        PD  17
      DATA DFACT/1.0D0,1.0D0,2.0D0,6.0D0,2.4D1,1.2D2,7.2D2,5.04D3,4.032D PD  18
     1D4,3.6288D5,3.6288D6,3.99168D7,4.790016D8/                        PD  19
                                                                        PD  20
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C                                                                       PD   21
      IF (N.LT.1.OR.N.GT.7) GO TO 9                                     PD   22
C***  TRANSLATE                                                         PD   23
      SVE=X(1)                                                          PD   24
      DO 1 I=1,N                                                        PD   25
    1 X(I)=X(I)-SVE                                                     PD   26
      XX=XX-SVE                                                         PD   27
    2 IF (ICF1.GT.ICF2) GO TO 3                                         PD   28
      CALL PHICEF(ICF1)                                                 PD   29
      ICF1=ICF1+1                                                       PD   30
      GO TO 2                                                           PD   31
    3 PHIDER=0D0                                                        PD   32
      I=K+1                                                             PD   33
      IF (I.LT.1)I=1                                                    PD   34
    4 IF (I.GT.N) GO TO 6                                               PD   35
      S=1D0                                                             PD   36
      CFT=0D0                                                           PD   37
      J2=I-K                                                            PD   38
      IF (J2.GT.I)J2=I                                                  PD   39
      DO 5 J=1,J2                                                       PD   40
      CFT=CFT+S*DFACT(I-J+1)/DFACT(I-J-K+1)*C(I,J)*(XX**(I-J-K))        PD   41
    5 S=-S                                                              PD   42
      PHIDER=PHIDER+A(I)*CFT                                            PD   43
      I=I+1                                                             PD   44
      GO TO 4                                                           PD   45
C***  RESET                                                             PD   46
    6 XX=XX+SVE                                                         PD   47
      DO 7 I=1,N                                                        PD   48
    7 X(I)=X(I)+SVE                                                     PD   49
    8 RETURN                                                            PD   50
    9 IERR=1                                                            PD   51
      WRITE (JWRITE,10) N                                               PD   52
   10 FORMAT (1H ,'*** PHIDER ERROR: N=',I11,' BUT 1<=N<=7 REQUIRED')   PD   53
      GO TO 8                                                           PD   54
      END                                                               PD   55


      SUBROUTINE PHETH                                                  PH    1
C                                                                       PH    2
C***  SUBROUTINE PHETH PRODUCES A CORRECTED VALUE OF Y(N+1)             PH    3
C                                                                       PH    4
      IMPLICIT REAL*8(A-Z)                                              PH    5
      COMMON /CRCOEF/P,A0,A1,A2,A3,A4,A5,H                              PH    6
      COMMON /PCR/DY0,DY1,DY2,DY3,DY4,DY5,DY6,X0,X1,X2,X3,X4,X5,X6,Y0,Y1 PH    7
     1,Y2,Y3,Y4,Y5,Y6                                                   PH    8
C                                                                       PH    9
      PH=P*H                                                            PH   10
C***  COMPUTE THE TREANOR F-VALUES                                      PH   11
      F0=0.0D0                                                          PH   12
      IF ((-PH).LT.174.673D0.AND.(-PH).GT.-180.218D0)F0=DEXP(-PH)       PH   13
      F1=(F0-1D0)/(-PH)                                                 PH   14
      F2=(F1-1D0)/(-PH)                                                 PH   15
      F3=(F2-(1D0/2D0))/(-PH)                                           PH   16
      F4=(F3-(1D0/6D0))/(-PH)                                           PH   17
      F5=(F4-(1D0/24D0))/(-PH)                                          PH   18
      F6=(F5-(1D0/120D0))/(-PH)                                         PH   19
C***  COMPUTE A CORRECTED VALUE OF Y(N+1)                               PH   20
      Y6=Y0+H*(A0*F1+H*(A1*F2+H*(2D0*A2*F3+H*(6D0*A3*F4+H*(24D0*A4*F5+H* PH   21
     1120D0*A5*F6))))                                                   PH   22
      RETURN                                                            PH   23
      END                                                               PH   24


      SUBROUTINE LOC(I,J,IR,N,M,MS)                                     LC    1
C                                                                       LC    2
C***  SUBROUTINE LOC COMPUTES A VECTOR SUBSCRIPT FOR AN ELEMENT IN A    LC    3
C***  MATRIX OF SPECIFIED STORAGE MODE                                  LC    4
C                                                                       LC    5
      IX=I                                                              LC    6
      L=J                                                               LC    7
      IF (MS-1)  1,2,5                                                  LC    8
    1 IRX=N*(L-1)+IX                                                    LC    9
      GO TO 7                                                           LC   10
    2 IF (IX-L)  3,4,4                                                  LC   11
    3 IRX=IX+(L*L-L)/2                                                  LC   12
      GO TO 7                                                           LC   13
    4 IRX=L+(IX*IX-IX)/2                                                LC   14
      GO TO 7                                                           LC   15
    5 IRX=0                                                             LC   16
      IF (IX-L)  7,6,7                                                  LC   17
    6 IRX=IX                                                            LC   18
    7 IR=IRX                                                            LC   19
      RETURN                                                            LC   20
      END                                                               LC   21


      SUBROUTINE MATA(A,B,N,M,MS)                                       MT    1
C                                                                       MT    2
C***  SUBROUTINE MATA PREMULTIPLIES A MATRIX BY ITS TRANSPOSE TO FORM   MT    3
C***  A SYMMETRIC MATRIX                                                MT    4
C                                                                       MT    5
      IMPLICIT REAL*8(A-H,O-Z)                                          MT    6
      DIMENSION A(1),B(1)                                               MT    7
C                                                                       MT    8
      DO 6 K=1,M                                                        MT    9
      KX=(K*K-K)/2                                                      MT   10
      DO 6 J=1,M                                                        MT   11
      IF (J-K)  1,1,6                                                   MT   12
    1 IR=J+KX                                                           MT   13
      B(IR)=0.0D0                                                       MT   14
      DO 6 I=1,N                                                        MT   15
      IF (MS)  2,4,2                                                    MT   16
    2 CALL LOC(I,J,IA,N,M,MS)                                           MT   17
      CALL LOC(I,K,IB,N,M,MS)                                           MT   18
      IF (IA)  3,6,3                                                    MT   19
    3 IF (IB)  5,6,5                                                    MT   20
    4 IA=N*(J-1)+I                                                      MT   21
      IB=N*(K-1)+I                                                      MT   22
    5 B(IR)=B(IR)+A(IA)*A(IB)                                           MT   23
    6 CONTINUE                                                          MT   24
      RETURN                                                            MT   25
      END                                                               MT   26


      SUBROUTINE MADD(A,B,R,N,M,MSA,MSB)                                MA    1
C                                                                       MA    2
```

```
C***  SUBROUTINE MADD ADDS TWO MATRICES ELEMENT BY ELEMENT TO FORM          MA    3
C***  RESULTANT MATRIX                                                     MA    4
C                                                                          MA    5
      IMPLICIT REAL*8(A-H,O-Z)                                             MA    6
      DIMENSION A(1),B(1),R(1)                                             MA    7
C                                                                          MA    8
C***  DETERMINE STORAGE MODE OF OUTPUT MATRIX                              MA    9
      IF (MSA-MSB)  2,1,2                                                  MA   10
    1 CALL LOC(M,N,MB,M,N,MSA)                                             MA   11
      GO TO 13                                                             MA   12
    2 MTEST=MSA*MSB                                                        MA   13
      MSR=0                                                                MA   14
      IF (MTEST)  4,4,3                                                    MA   15
    3 MSR=1                                                                MA   16
    4 IF (MTEST-2)  6,6,5                                                  MA   17
    5 MSR=2                                                                MA   18
C***  LOCATE ELEMTENTS AND PERFORM ADDITIONS                               MA   19
    6 DO 12 J=1,N                                                          MA   20
      DO 12 I=1,M                                                          MA   21
      CALL LOC(I,J,IJB,M,N,MSB)                                            MA   22
      IF (IJB)  7,12,7                                                     MA   23
    7 CALL LOC(I,J,IJA,M,N,MSA)                                            MA   24
      AEL=0.0                                                              MA   25
      IF (IJA)  8,9,8                                                      MA   26
    8 AEL=A(IJA)                                                           MA   27
    9 CALL LOC(I,J,IJB,M,N,MSB)                                            MA   28
      BEL=0.0                                                              MA   29
      IF (IJB)  10,11,10                                                   MA   30
   10 BEL=B(IJB)                                                           MA   31
   11 R(IJB)=AEL+BEL                                                       MA   32
   12 CONTINUE                                                             MA   33
      RETURN                                                               MA   34
C***  ADD MATRICES OF LIKE-STORAGE MODE                                    MA   35
   13 DO 14 I=1,MM                                                         MA   36
   14 R(I)=A(I)+B(I)                                                       MA   37
      RETURN                                                               MA   38
      END                                                                  MA   39


      SUBROUTINE GAMX(K)
C
C***  SUBROUTINE GAMX CALCULATES A BIAS AND GAIN CORRECTION FOR VALUES     GP    1
C***  OF PITCH ANGLE                                                       GP    2
C                                                                          GP    3
      IMPLICIT REAL*8(A-H,O-Z)                                             GP    4
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F   GP    5
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450   GP    6
     1),C(450,11),X(450,1),WKAR(250),CFM(14),SGN(4),SGD(4),FT1(450),FT2(   GP    7
     1450),PWR(450),CL(450),XX(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S    GP    8
     1,RHO,YIA,EXPX,PLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX   GP    9
     12,IEX3,IEX4,METRIC,L1,L2,IEQNS(18),IERR                              GP   10
C                                                                          GP   11
C***  FORM COEFFICIENTS FOR LEAST SQUARES                                  GP   12
      DO 1 I=1,K                                                           GP   13
      C(I,1)=1.0D0                                                         GP   14
      C(I,2)=F2(I)                                                         GP   15
    1 X(I,1)=F6(I)*FT1(I)                                                  GP   16
C***  PERFORM LEAST SQUARES FOR GAIN AND BIAS                              GP   17
      CALL LLSQAR(C,X,K,2,1,450,450,16,WKAR,IER,JWRITE)                    GP   18
      IF (IER.EQ.129) GO TO 2                                              GP   19
      GO TO 4                                                              GP   20
    2 WRITE (JWRITE,3)                                                     GP   21
    3 FORMAT (1X,////,10X,'ZERO MATRIX ENCOUNTERED IN SUBROUTINE GAMX.     GP   22
     1TO NEXT DATA SET, IF ANY.',//)                                       GP   23
      IERR=1                                                               GP   24
      RETURN                                                               GP   25
    4 WRITE (JWRITE,5) X(2,1),X(1,1)                                       GP   26
    5 FORMAT (1X,/,42X,50('-'),/,42X,'|',48X,'|',/,42X,'|  PITCH-ANGLE G   GP   27
     1AIN = ',1PD18.11,9X,'|',/,42X,'|  PITCH-ANGLE BIAS = ',1PD18.11,'    GP   28
     1RADIAN  |',/,42X,'|',48X,'|',/,42X,50('-'),/)                        GP   29
C***  PERFORM CORRECTIONS TO PITCH ANGLE VALUES                            GP   30
      DO 6 I=1,K                                                           GP   31
    6 F2(I)=X(2,1)*F2(I)+X(1,1)                                            GP   32
      RETURN                                                               GP   33
C                                                                          GP   34
      ENTRY MPITCH(K)                                                      GP   35
C                                                                          GP   36
C***  ENTRY MPITCH SOLVES FOR PITCH ANGLE BY NEWTON-RAPHSON                GP   37
C                                                                          GP   38
C***  INITIALIZE PARAMETERS                                                GP   39
      CALL CHNGE(SGN)                                                      GP   40
C***  BEGIN SOLUTION LOOP                                                  GP   41
      DO 9 I=1,K                                                           GP   42
      IT=0                                                                 GP   43
      TS=F2(I)                                                             GP   44
      T=TS                                                                 GP   45
      AM=DABS(F6(I))                                                       GP   46
      IF (F6(I).LT.0.0D0) CALL SIGNS(SGN,IEX1,IEX2,IEX3,IEX4)              GP   47
C***  COMPUTE POWER AND DRAG COEFFICIENT                                   GP   48
      PWR=CFM(1)*CFM(2)*F4(I)**EX1+CFM(3)*F4(I)**EX2+CFM(4)*F4(I)**EX3+C   GP   49
     1FM(5)*F4(I)**EX4                                                     GP   50
      CD=CFM(6)+SGN(1)*CFM(7)*AM**IEX1+SGN(2)*CFM(8)*AM**IEX2+SGN(3)*CFM   GP   51
     1(9)*AM**IEX3+SGN(4)*CFM(10)*AM**IEX4                                 GP   52
      IF (F6(I).LT.0.0D0) CALL CHNGE(SGN)                                  GP   53
C***  FORM NEWTON-RAPHSON EQUATIONS                                        GP   54
    7 FT=DCOS(F6(I)+TIA)*PWR/(F1(I)*F4(I))-(DSIN(T-F6(I))+F8(I)/G+F5(I)*   GP   55
     1S*F4(I)**2*CD/(2.0D0*F1(I)))                                         GP   56
      FTP=-DCOS(T-F6(I))                                                   GP   57
      IF (DABS(FTP).LT.1.0D-10) GO TO 8                                    GP   58
      IT=IT+1                                                              GP   59
      TT=T-FT/FTP                                                          GP   60
      IF (DABS(TT-T).LT.1.0D-16.OR.IT.GE.40) GO TO 8                       GP   61
      T=TT                                                                 GP   62
      GO TO 7                                                              GP   63
C***  ADJUST PITCH ANGLE                                                   GP   64
    8 F2(I)=TS+0.333333D0*(TS-T)                                           GP   65
    9 CONTINUE                                                             GP   66
      RETURN                                                               GP   67
      END                                                                  GP   68
                                                                           GP   69
                                                                           GP   70


      SUBROUTINE LSD(X,Y,N,AL,M,RMS,LMET,IERR,JWRITE,MTH)
C
C***  SUBROUTINE LSD IS A MODIFICATION OF THE GENERAL LEAST-SQUARE-        LD    1
C***  DISTANCE CURVE FITTING PROGRAM GIVEN IN THE FOLLOWING REFERENCE:     LD    2
C***     A LEAST-SQUARE-DISTANCE CURVE-FITTING TECHNIQUE                   LD    3
C***     JOHN Q. HOWELL, NASA TN D-6374, JULY 1971                         LD    4
C                                                                          LD    5
                                                                           LD    6
                                                                           LD    7
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      IMPLICIT REAL*8(A-H,O-Z)                                          LD    8
      DIMENSION A(4,4),AL(4),B(4,1),DIS(450),DYDAL(4,450),J(450),X(N),XX LD    9
     1(450),Y(N),YY(450),SAL(4),HEAD(32),IPT(450)                       LD   10
C                                                                       LD   11
C***  SET INITIAL PARAMETERS                                            LD   12
      RANGE=0.01D0                                                      LD   13
      MX=100                                                            LD   14
      ERR=0.05D0                                                        LD   15
      RMSOLD=0.0D0                                                      LD   16
      MTHP1=MTH+1                                                       LD   17
C***  START ITERATION                                                   LD   18
      DO 30 ITER=1,MX                                                   LD   19
C***  FIND CLOSEST POINTS ON CURVE                                      LD   20
      IFAIL=0                                                           LD   21
      DO 12 I=1,N                                                       LD   22
      W(I)=1.0D0                                                        LD   23
C***  OBTAIN INITIAL GUESS AT X-COORDINATE OF CLOSEST POINT             LD   24
C***  (XX(I),YY(I)) ON CURVE TO DATA POINT (X(I),Y(I)) FROM THE         LD   25
C***  INTERSECTION OF A PERPENDICULAR FROM THE DATA POINT WITH          LD   26
C***  THE TANGENT TO THE CURVE AT THE POINT (X(I),F(X(I))) WHERE        LD   27
C***  THE CURVE EQUATION IS Y = F(X)                                    LD   28
      CALL FNCTNA(AL,X(I),F,DFDX,MTHP1)                                 LD   29
      XX(I)=X(I)-(F-Y(I))*DFDX/(1.0D0+DFDX*DFDX)                        LD   30
C***  SEARCH ABOUT THIS POINT XX(I) FOR A SIGN CHANGE IN THE            LD   31
C***  FUNCTION   (F(X) - Y(I))*DFDX + (X - X(I))                        LD   32
      IF (X(I).NE.0.0D0) GO TO 1                                        LD   33
      YY(I)=F                                                           LD   34
      XX(I)=X(I)                                                        LD   35
      GO TO 11                                                          LD   36
    1 IF (I.NE.1) GO TO 2                                               LD   37
      DXUPR=RANGE*(X(I+1)-X(I))                                         LD   38
      DXLWR=RANGE*X(I)                                                  LD   39
      GO TO 3                                                           LD   40
    2 DXLWR=RANGE*(X(I)-X(I-1))                                         LD   41
      DXUPR=DXLWR                                                       LD   42
      IF (I.NE.N) DXUPR=RANGE*(X(I+1)-X(I))                             LD   43
    3 XLWR=XX(I)                                                        LD   44
      XUPR=XLWR                                                         LD   45
      DO 5 J=1,100                                                      LD   46
      CALL FNCTNA(AL,XLWR,FLWR,DFLWR,MTHP1)                             LD   47
      CALL FNCTNA(AL,XUPR,FUPR,DFUPR,MTHP1)                             LD   48
      FUNLWR=(FLWR-Y(I))*DFLWR+(XLWR-X(I))                              LD   49
      FUNUPR=(FUPR-Y(I))*DFUPR+(XUPR-X(I))                              LD   50
      IF (FUNLWR*FUNUPR)  6,4,4                                         LD   51
    4 XLWR=XLWR-DXLWR                                                   LD   52
      XUPR=XUPR+DXUPR                                                   LD   53
      IF (XLWR.LT.0.0D0) XLWR=0.0D0                                     LD   54
    5 CONTINUE                                                          LD   55
      DIS(I)=0.0D0                                                      LD   56
      IFAIL=IFAIL+1                                                     LD   57
      IPT(IFAIL)=I                                                      LD   58
      W(I)=0.0D0                                                        LD   59
      GO TO 12                                                          LD   60
C***  SIGN CHANGE HAS BEEN FOUND.  FIND ROOT BY METHOD OF FALSE         LD   61
C***  POSITION.                                                         LD   62
    6 XOLD=0.0D0                                                        LD   63
      DO 9 J=1,100                                                      LD   64
      XROOT=(XLWR*FUNUPR-XUPR*FUNLWR)/(FUNUPR-FUNLWR)                   LD   65
      IF (DABS(1.0D0-XOLD/XROOT).LT.1.0D-03) GO TO 10                   LD   66
      XOLD=XROOT                                                        LD   67
      CALL FNCTNA(AL,XROOT,FROOT,DFROOT,MTHP1)                          LD   68
      FUNRT=(FROOT-Y(I))*DFROOT+(XROOT-X(I))                            LD   69
      IF (FUNLWR*FUNRT)  7,10,8                                         LD   70
    7 FUNUPR=FUNRT                                                      LD   71
      XUPR=XROOT                                                        LD   72
      GO TO 9                                                           LD   73
    8 FUNLWR=FUNRT                                                      LD   74
      XLWR=XROOT                                                        LD   75
    9 CONTINUE                                                          LD   76
      DIS(I)=0.0D0                                                      LD   77
      IFAIL=IFAIL+1                                                     LD   78
      IPT(IFAIL)=I                                                      LD   79
      W(I)=0.0D0                                                        LD   80
      GO TO 12                                                          LD   81
C***  CLOSEST POINT FOUND, NOW FIND DISTANCE                            LD   82
   10 XX(I)=XROOT                                                       LD   83
      YY(I)=FROOT                                                       LD   84
   11 DX=XX(I)-X(I)                                                     LD   85
      DY=YY(I)-Y(I)                                                     LD   86
      DIS(I)=DSQRT(DX*DX+DY*DY)                                         LD   87
   12 CONTINUE                                                          LD   88
      IF (IFAIL.NE.0) WRITE (JWRITE,13) ITER                            LD   89
   13 FORMAT (1X,///,24X,79HTHE SHORTEST DISTANCE COULD NOT BE FOUND FOR LD   90
     1THE FOLLOWING POINTS ON ITERATION#,I3,1H:,/)                      LD   91
      IF (IFAIL.NE.0) WRITE (JWRITE,14) (IPT(I),I=1,IFAIL)              LD   92
   14 FORMAT (24X,21(I3,1H,))                                           LD   93
C***  COMPLETE SET OF CLOSEST POINTS AND DISTANCES FOUND                LD   94
C***  NOW FIND NEW SET OF PARAMETERS                                    LD   95
      PC=0.05D0                                                         LD   96
      IPCF=PC*N                                                         LD   97
C***  EXIT FROM ROUTINE IF 5 PERCENT OR MORE OF CLOSEST DISTANCES       LD   98
C***  CANNOT BE FOUND                                                   LD   99
      IF (IFAIL.GE.IPCF) LAST=1                                         LD  100
      IF (IFAIL.GT.IPCF.AND.ITER.EQ.1) GO TO 34                         LD  101
      IF (IFAIL.GE.IPCF) GO TO 32                                       LD  102
      SUMDIS=0.0D0                                                      LD  103
      DO 15 I=1,N                                                       LD  104
   15 SUMDIS=SUMDIS+DIS(I)*DIS(I)                                       LD  105
C***  FIND ROOT-MEAN-SQUARE DEVIATION                                   LD  106
      RMS=DSQRT(SUMDIS/(N-IFAIL))                                       LD  107
      IF (ITER.GT.1) GO TO 17                                           LD  108
      RMSS=RMS                                                          LD  109
      DO 16 I=1,4                                                       LD  110
   16 SAL(I)=AL(I)                                                      LD  111
C***  CHECK FOR CONVERGENCE                                             LD  112
   17 IF (DABS(RMS-RMSOLD).LT.ERR*RMS) GO TO 32                         LD  113
      IF (ITER.GT.1.AND.RMS.GT.RMSS) GO TO 32                           LD  114
      RMSS=RMS                                                          LD  115
      DO 18 I=1,4                                                       LD  116
   18 SAL(I)=AL(I)                                                      LD  117
C***  GENERATE MATRIX COEFFICIENTS OF LINEAR SIMULTANEOUS EQUATIONS     LD  118
      CALL FNCTNB(AL,N,XX,YY,DYDAL,MTHP1)                               LD  119
      DO 21 K=1,4                                                       LD  120
      B(K,1)=0.0D0                                                      LD  121
      DO 21 I=1,N                                                       LD  122
      B(K,1)=B(K,1)+(Y(I)-YY(I))*DYDAL(K,I)*W(I)                        LD  123
      IF (W(I).EQ.0.0D0) GO TO 20                                       LD  124
      IF (DIS(I).EQ.0.0D0) GO TO 19                                     LD  125
      DYDAL(K,I)=(Y(I)-YY(I))*DYDAL(K,I)/DIS(I)                         LD  126
      GO TO 21                                                          LD  127
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   19 CALL FNCTNA(AL,XX(I),F,DF,NTHP1)                                  LD  128
      IF (DF.EQ.0.0D0) GO TO 20                                         LD  129
      DYDAL(K,I)=DSQRT(1.0D0/(1.0D0+1.0D0/DF/DF))*DYDAL(K,I)            LD  130
      GO TO 21                                                          LD  131
   20 DYDAL(K,I)=0.0D0                                                  LD  132
   21 CONTINUE                                                          LD  133
      DO 24 K=1,N                                                       LD  134
      DO 23 J=K,N                                                       LD  135
      A(K,J)=0.0D0                                                      LD  136
      DO 22 I=1,M                                                       LD  137
   22 A(K,J)=A(K,J)+DYDAL(K,I)*DYDAL(J,I)                               LD  138
   23 A(J,K)=A(K,J)                                                     LD  139
   24 CONTINUE                                                          LD  140
C***  INCREASE STABILITY WITH DAMPING TECHNIQUE                        LD  141
      T=0.0D0                                                           LD  142
      DO 25 I=1,N                                                       LD  143
   25 T=T+B(I,1)*B(I,1)                                                 LD  144
      WW=0.500*SUMDIS/T                                                 LD  145
      DO 26 I=1,N                                                       LD  146
   26 A(I,I)=A(I,I)+0.5D0/WW                                            LD  147
C***  SOLVE THE LINEAR SIMULTANEOUS EQUATION FOR CORRECTIONS TO         LD  148
C***  THE AL(I) AND GENERATE NEW AL(I)                                 LD  149
      CALL LLSQAR(A,B,N,N,1,4,4,16,NEAR,IER,JWRITE)                     LD  150
      IF (IER.EQ.129)IER=1                                              LD  151
      IF (IERR.NE.0) GO TO 32                                           LD  152
      AL(1)=AL(1)+B(1,1)                                                LD  153
      GO TO (27,27,28,28,29,29),NTHP1                                   LD  154
   27 AL(2)=AL(2)+B(2,1)                                                LD  155
      GO TO 30                                                          LD  156
   28 AL(2)=AL(2)+B(2,1)                                                LD  157
      AL(3)=AL(3)+B(3,1)                                                LD  158
      AL(4)=AL(4)+B(4,1)                                                LD  159
      GO TO 30                                                          LD  160
   29 AL(3)=AL(3)+B(2,1)                                                LD  161
      AL(4)=AL(4)+B(3,1)                                                LD  162
   30 CONTINUE                                                          LD  163
      WRITE (JWRITE,31) NX,ERR                                          LD  164
   31 FORMAT (1X,9('***'),'AFTER',I4,' ITERATIONS (1.0 - RMS/RMSOLD), THE LD  165
     1RELATIVE ERROR BETWEEN'/1X,11X,'TWO SUCCESSIVE VALUES OF RMS, STIL LD  166
     1L EXCEEDS THE SPECIFIED ERROR PARAMETER =',D10.3)                 LD  167
      RETURN                                                            LD  168
   32 RMS=RMSS                                                          LD  169
      DO 33 I=1,4                                                       LD  170
   33 AL(I)=SAL(I)                                                      LD  171
   34 RETURN                                                            LD  172
      END                                                               LD  173
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```
      SUBROUTINE FNCTNA(A,X,Y,DYDX,NTHP1)                               FA    1
C                                                                       FA    2
C***  SUBROUTINE FNCTNA COMPUTES THE VALUE OF THE FITTED FUNCTION AND   FA    3
C***  ITS X-DERIVATIVE                                                 FA    4
C                                                                       FA    5
      IMPLICIT REAL*8(A-H,O-Z)                                          FA    6
      DIMENSION A(4)                                                    FA    7
C                                                                       FA    8
      GO TO (1,1,2,2,4,4),NTHP1                                         FA    9
C***  CALCULATE FUNCTION VALUE AND ITS DERIVATIVE VALUE                 FA   10
    1 Y=A(1)+A(2)*X                                                     FA   11
      DYDX=A(2)                                                         FA   12
      RETURN                                                            FA   13
C***  CHECK ARGUMENT FOR ERROR                                          FA   14
    2 IF (X.LE.0.0D0) GO TO 3                                           FA   15
C***  CALCULATE FUNCTION VALUE AND ITS DERIVATIVE VALUE                 FA   16
      Y=A(1)+A(2)*X+A(3)*X**A(4)                                        FA   17
      DYDX=A(2)+A(3)*A(4)*X**(A(4)-1.0D0)                               FA   18
      RETURN                                                            FA   19
C***  SET FUNCTION VALUE AND ITS DERIVATIVE VALUE                       FA   20
    3 Y=A(1)                                                            FA   21
      DYDX=0.0D0                                                        FA   22
      RETURN                                                            FA   23
C***  CHECK ARGUMENT FOR ERROR                                          FA   24
    4 IF (X.LE.0.0D0) GO TO 5                                           FA   25
C***  CALCULATE FUNCTION VALUE AND ITS DERIVATIVE VALUE                 FA   26
      Y=A(1)+A(3)*X**A(4)                                               FA   27
      DYDX=A(3)*A(4)*X**(A(4)-1.0D0)                                    FA   28
      RETURN                                                            FA   29
C***  SET FUNCTION VALUE AND ITS DERIVATIVE VALUE                       FA   30
    5 Y=A(1)                                                            FA   31
      DYDX=0.0D0                                                        FA   32
      RETURN                                                            FA   33
      END                                                               FA   34
```

```
      SUBROUTINE FNCTNB(A,N,X,Y,DYDA,NTHP1)                             FB    1
C                                                                       FB    2
C***  SUBROUTINE FNCTNB COMPUTES THE VALUE OF THE FITTED FUNCTION       FB    3
C***  AND ITS PARTIAL DERIVATIVES WITH RESPECT TO THE COEFFICIENTS      FB    4
C                                                                       FB    5
      IMPLICIT REAL*8(A-H,O-Z)                                          FB    6
      DIMENSION A(4),DYDA(4,N),X(N),Y(N)                                FB    7
C                                                                       FB    8
      GO TO (1,1,3,3,6,6),NTHP1                                         FB    9
C***  FOR NTH=0,1                                                       FB   10
    1 DO 2 I=1,N                                                        FB   11
C***  CALCULATE PARTIAL DERIVATIVES                                     FB   12
      DYDA(1,I)=1.0D0                                                   FB   13
      DYDA(2,I)=X(I)                                                    FB   14
    2 Y(I)=A(1)+A(2)*X(I)                                               FB   15
      RETURN                                                            FB   16
C***  FOR NTH=2,3                                                       FB   17
    3 DO 5 I=1,N                                                        FB   18
C***  CALCULATE PARTIAL DERIVATIVES                                     FB   19
      DYDA(1,I)=1.0D0                                                   FB   20
      DYDA(2,I)=X(I)                                                    FB   21
C***  TEST ARGUMENT                                                     FB   22
      IF (X(I).LE.0.0D0) GO TO 4                                        FB   23
      DYDA(3,I)=X(I)**A(4)                                              FB   24
      DYDA(4,I)=A(3)*X(I)**A(4)*DLOG(X(I))                              FB   25
C***  CALCULATE FUNCTION VALUE                                          FB   26
      Y(I)=A(1)+A(2)*X(I)+A(3)*X(I)**A(4)                               FB   27
      GO TO 5                                                           FB   28
C***  SET PARTIAL DERIVATIVES AND FUNCTION TO SPECIFIED VARIABLES       FB   29
    4 DYDA(3,I)=0.0D0                                                   FB   30
      DYDA(4,I)=0.0D0                                                   FB   31
      Y(I)=A(1)                                                         FB   32
    5 CONTINUE                                                          FB   33
      RETURN                                                            FB   34
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C***  FOR NTH=4,5                                                    FB  35
    6 DO 8 I=1,M                                                     FB  36
      DYDA(1,I)=1.0D0                                                FB  37
C***  TEST ARGUMENT                                                  FB  38
      IF (X(I).LE.0.0D0) GO TO 7                                     FB  39
      DYDA(2,I)=X(I)**A(4)                                           FB  40
      DYDA(3,I)=A(3)*X(I)**A(4)*DLOG(X(I))                           FB  41
C***  CALCULATE FUNCTION VALUE                                       FB  42
      Y(I)=A(1)+A(3)*X(I)**A(4)                                      FB  43
      GO TO 8                                                        FB  44
    7 DYDA(2,I)=0.0D0                                                FB  45
      DYDA(3,I)=0.0D0                                                FB  46
      Y(I)=A(1)                                                      FB  47
    8 CONTINUE                                                       FB  48
      RETURN                                                         FB  49
      END                                                            FB  50


      SUBROUTINE GDEQN(K,MNB,ICK)                                    GD   1
C                                                                    GD   2
C***  SUBROUTINE GDEQN SOLVES FOR POWER AND LIFT COEFFICIENTS BY USING GD   3
C***  EQUATION OF MOTION NORMAL TO FLIGHT PATH AND MODIFIES THE A PRIORI GD   4
C***  VALUES AND THEIR WEIGHTS, IF NEEDED                            GD   5
C                                                                    GD   6
      IMPLICIT REAL*8(A-H,O-Z)                                       GD   7
      DIMENSION TS(8),LOC(8,18),COF(8),APWF(13,5)                    GD   8
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F GD   9
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 GD  10
     1),C(450,11),X(450,1),WKAR(250),CFR(14),SGM(4),SGD(4),FT1(450),FT2( GD  11
     1450),PWR(450),XX(450),CD(450),X1(450),X2(450),EX1,EX2,EX3,EX4,G,S GD  12
     1,RHO,TIA,EXPX,FLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX GD  13
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                        GD  14
      COMMON /LAB1/AP(13),WGT(13),CRMIN(13),CRMAX(13)                GD  15
      INTEGER IEQN(18)/4,5,5,5,5,5,5,6,6,6,6,6,6,4,5,5,6,6/          GD  16
      DATA LOC/1,6,7,8,0,0,0,0,1,2,6,7,8,0,0,0,0,1,2,6,7,8,0,0,0,1,2,6,7,8 GD  17
     1,0,0,0,1,3,6,7,8,0,0,0,0,1,3,6,7,8,0,0,0,0,1,3,6,7,8,0,0,0,0,1,2,3,6,7,8 GD  18
     1,0,0,0,1,2,3,6,7,8,0,0,0,1,2,3,6,7,8,0,0,0,1,3,4,6,7,8,0,0,0,1,3,4,6,7,8,0 GD  19
     1,0,0,1,3,4,6,7,8,0,0,0,1,6,7,8,0,0,0,0,1,2,6,7,8,0,0,0,0,1,3,6,7,8,0,0,0,0 GD  20
     1,1,2,3,6,7,8,0,0,0,1,3,4,6,7,8,0,0,0/,APWF/1.0D0,1.0D0,1.0D0,1.0D0,1.0D0,1.0 GD  21
     1D0,1.0D0,1.0D0,1.0D0,1.0D0,1.0D0,1.0D0,1.0D0,1.0D0,2.0D-2,1.0D+0,2 GD  22
     1.0D-1,2.0D+4,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D GD  23
     1+0,1.0D+3,2.0D-3,1.0D+0,2.0D-2,2.0D+3,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0, GD  24
     11.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+3,2.0D-4,1.0D+0,2.0D-3,2.0D+2,1.0 GD  25
     1D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.CD+4,2.0D-5 GD  26
     1,1.0D+0,2.0D-3,2.0D+1,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1. GD  27
     10D+0,1.0D+0,1.0D+4/                                            GD  28
C                                                                    GD  29
      IF (ICK.GT.1) GO TO 17                                         GD  30
      WRITE (JWRITE,1)                                               GD  31
    1 FORMAT (1X,///,51X,30HNORMAL-TO-FLIGHT-PATH SOLUTION,/)        GD  32
      WRITE (JWRITE,2)                                               GD  33
    2 FORMAT (28X,76('*'),/,28X,'*',74X,'*')                         GD  34
C***  DETERMINE NUMBER OF UNKNOWNS                                   GD  35
      NUM=IEQN(MNB)                                                  GD  36
      DO 5 I=1,K                                                     GD  37
C***  DETERMINE GENERAL TERMS FOR MATRIX FORMULATION                 GD  38
      TS(1)=DSIN(F6(I)*TIA)                                          GD  39
      TS(2)=TS(1)*F4(I)**EX1                                         GD  40
      TS(3)=TS(1)*F4(I)**EX2                                         GD  41
      TS(4)=TS(1)*F4(I)**EX3                                         GD  42
      TS(5)=TS(1)*F4(I)**EX4                                         GD  43
      TS(6)=F5(I)*S*F4(I)**3/2.0D0                                   GD  44
      TS(7)=TS(6)*F6(I)                                              GD  45
      TS(8)=TS(6)*F6(I)**EXPX                                        GD  46
C***  FORM COEFFICIENTS FOR LEAST SQUARES                            GD  47
      DO 4 J=1,NUM                                                   GD  48
    4 C(I,J)=TS(LOC(J,MNB))                                          GD  49
    5 X(I,1)=F4(I)**2*F1(I)/G*(FT2(I)+G*DCOS(FT1(I))/F4(I))          GD  50
C***  EXACT LEAST SQUARES                                            GD  51
      CALL LLSQAR(C,X,K,IEQN(MNB),1,450,450,16,WKAR,IER,JWRITE)      GD  52
C***  CHECK FOR ERROR                                                GD  53
      IF (IER.EQ.129) GO TO 6                                        GD  54
      GO TO 8                                                        GD  55
    6 WRITE (JWRITE,7)                                               GD  56
    7 FORMAT (1X,//,10X,'ZERO MATRIX ENCOUNTERED IN GDEQN.  TO NEXT DATA GD  57
     1 SET, IF ANY.',//)                                             GD  58
      IERR=1                                                         GD  59
      RETURN                                                         GD  60
C***  DEFINE COEFFICIENTS IN CORRECT ORDER                           GD  61
    8 DO 9 J=1,8                                                     GD  62
    9 COF(J)=0.0D0                                                   GD  63
      DO 10 J=1,NUM                                                  GD  64
   10 COF(LOC(J,MNB))=X(J,1)                                         GD  65
C***  DETERMINE FIT ERROR                                            GD  66
      SSX=0.0D0                                                      GD  67
      DO 11 J=1,K                                                    GD  68
      P=COF(1)+COF(2)*F4(J)**EX1+COF(3)*F4(J)**EX2+COF(4)*F4(J)**EX3+COF GD  69
     1(5)*F4(J)**EX4                                                 GD  70
      CL=COF(6)+COF(7)*F6(J)+COF(8)*F6(J)**EXPX                      GD  71
      SS=DSIN(F6(J)+TIA)*P+F5(J)*S*F4(J)**3/2.0D0*CL-(F4(J)**2*FT1(J)/G*( GD  72
     1FT2(J)+G*DCOS(FT1(J))/F4(J)))                                  GD  73
   11 SSX=SSX+SS*SS                                                  GD  74
C***  WRITE MODEL VALUES                                             GD  75
      IF (METRIC.NE.0) GO TO 13                                      GD  76
      WRITE (JWRITE,12) MNB,COF(1),COF(6),COF(2),COF(7),COF(3),COF(8),CO GD  77
     1F(4),COF(5),SSX                                                GD  78
   12 FORMAT (28X,'*',1X,'MODEL ',I2,3X,'P0 = ',1PD23.16,3X,'CLA0= ',1PD GD  79
     123.16,2X,'*',/,28X,'*',12X,'P1 = ',1PD23.16,3X,'CLA = ',1PD23.16,2 GD  80
     1X,'*',/,28X,'*',12X,'P2 = ',1PD23.16,3X,'CLAX= ',1PD23.16,2X,'*',/ GD  81
     1,28X,'*',12X,'P3 = ',1PD23.16,34X,'*',/,28X,'*',12X,'P4 = ',1PD23. GD  82
     116,34X,'*',/,28X,'*',74X,'*',/,28X,'*',1X,'FIT ERROR= ',D23.16,39X GD  83
     1,'*',/,28X,'*',74X,'*',/,28X,76('*'))                          GD  84
      GO TO 14                                                       GD  85
   13 P0=COF(1)*1.355818D-3                                          GD  86
      P1=COF(2)*1.355818D-3                                          GD  87
      P2=COF(3)*1.355818D-3                                          GD  88
      P3=COF(4)*1.355818D-3                                          GD  89
      P4=COF(5)*1.355818D-3                                          GD  90
      WRITE (JWRITE,12) MNB,P0,COF(6),P1,COF(7),P2,COF(8),P3,P4,SSX  GD  91
   14 WRITE (JWRITE,15)                                              GD  92
   15 FORMAT (28X,'*',74X,'*',/,28X,76('*'),//)                      GD  93
C***  MODIFY A PRIORI VALUES AND WEIGHTS IF NECESSARY                GD  94
      IF (WGT(1).GT.0.0D0) GO TO 16                                  GD  95
C***  MODIFICATION TO FIRST-POWER-COEFFICIENT A PRIORI               GD  96
      AP(1)=22).2D0*CFR(1)**2/(220.2D0*CFR(1)+COF(1))                GD  97
      WGT(1)=AP(1)*AP(1)*20.0D0                                      GD  98
C***  MODIFICATION TO SECOND-POWER-COEFFICIENT A PRIORI              GD  99
      AP(2)=AP(2)                                                    GD 100
      WGT(2)=WGT(2)                                                  GD 101
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C***  MODIFICATION TO THIRD-POWER-COEFFICIENT A PRIORI                  GD  102
      AP(3)=127.0D0*CFM(3)**2/(126.0D0*CFM(3)+COF(3))                   GD  103
      WGT(3)=AP(3)*AP(3)*200.0D0                                        GD  104
C***  MODIFICATION TO FOURTH-POWER-COEFFICIENT A PRIORI                 GD  105
      AP(4)=34.3D0*CFM(4)**2/(33.3D0*CFM(4)+COF(4))                     GD  106
      WGT(4)=AP(4)*AP(4)*2.0D+07                                        GD  107
C***  MODIFICATION TO FIFTH-POWER-COEFFICIENT A PRIORI                  GD  108
      AP(5)=AP(5)                                                       GD  109
      WGT(5)=WGT(5)                                                     GD  110
   16 RETURN                                                            GD  111
C***  MODIFY A PRIORI WEIGHTS DUE TO TRAJECTORY PREDICTION ROUTINE'S    GD  112
C***  ITERATION NUMBER                                                  GD  113
   17 DO 18 I=1,13                                                      GD  114
      IF (WGT(I).EQ.0.0D0) GO TO 18                                     GD  115
      WGT(I)=AP(I)*AP(I)*APWP(I,ICK)                                    GD  116
   18 CONTINUE                                                          GD  117
      RETURN                                                            GD  118
      END                                                               GD  119



      SUBROUTINE SIGNS(Y,X1,X2,X3,X4)                                   SN    1
C                                                                       SN    2
C***  SUBROUTINE SIGNS DETERMINES THE CORRECT SIGN ON TERMS IN          SN    3
C***  COMPUTING THE DRAG COEFFICIENT EXPRESSION OR ITS DERIVATIVES IN   SN    4
C***  RELATION TO ARGUMENT AND EXPONENTS                                SN    5
C                                                                       SN    6
      IMPLICIT REAL*8(A-H,O-Z)                                          SN    7
      INTEGER*4 X1,X2,X3,X4                                             SN    8
      DIMENSION Y(4),L(4)                                               SN    9
C                                                                       SN   10
      DO 1 I=1,4                                                        SN   11
    1 Y(I)=1.0D0                                                        SN   12
      L(1)=X1                                                           SN   13
      L(2)=X2                                                           SN   14
      L(3)=X3                                                           SN   15
      L(4)=X4                                                           SN   16
      DO 2 I=1,4                                                        SN   17
      IF (((L(I)/2)*2).NE.L(I))Y(I)=-1.0D0                              SN   18
    2 CONTINUE                                                          SN   19
      RETURN                                                            SN   20
      ENTRY CHNGE(Y)                                                    SN   21
      DO 3 I=1,4                                                        SN   22
    3 Y(I)=1.0D0                                                        SN   23
      RETURN                                                            SN   24
      END                                                               SN   25



      SUBROUTINE LLSQAR(A,B,M,NA,NB,IA,IB,IDGT,WKAREA,IER,JWRITE)       LQ    1
C                                                                       LQ    2
C***  SUBROUTINE LLSQAR PERFORMS A LEAST SQUARES SOLUTION OF A OVER-    LQ    3
C***  DETERMINED SYSTEM OF LINEAR EQUATIONS                             LQ    4
C                                                                       LQ    5
      DIMENSION A(IA,1),B(IB,1),WKAREA(1)                               LQ    6
      REAL*8 SUM                                                        LQ    7
      REAL*8 A,B,WKAREA                                                 LQ    8
C                                                                       LQ    9
C***  INITIALIZE IER                                                    LQ   10
      IER=0                                                             LQ   11
C***  FIND THE PSEUDO-INVERSE OF MATRIX A                               LQ   12
      CALL LPSDOR(A,M,NA,IA,A,IDGT,WKAREA,IER,JWRITE)                   LQ   13
      IF (IER.NE.0) GO TO 5                                             LQ   14
C***  SOLVE THE EQUATION BY MULTIPLYING A-INVERSE AND B                 LQ   15
      DO 4 I=1,NB                                                       LQ   16
      DO 2 J=1,NA                                                       LQ   17
      CALL VXPZRO                                                       LQ   18
      DO 1 K=1,M                                                        LQ   19
      CALL VXPMUL(A(K,J),B(K,I))                                        LQ   20
    1 CONTINUE                                                          LQ   21
      CALL VXPSTO(SUM)                                                  LQ   22
      WKAREA(J)=SUM                                                     LQ   23
    2 CONTINUE                                                          LQ   24
C***  MOVE THE RESULTS INTO MATRIX B                                    LQ   25
      DO 3 J=1,NA                                                       LQ   26
      B(J,I)=WKAREA(J)                                                  LQ   27
    3 CONTINUE                                                          LQ   28
    4 CONTINUE                                                          LQ   29
      GO TO 6                                                           LQ   30
    5 IER=129                                                           LQ   31
      CALL UERTST(IER,6HLLSQAR,JWRITE)                                  LQ   32
    6 RETURN                                                            LQ   33
      END                                                               LQ   34



      SUBROUTINE LPSDOR(A,M,N,IA,AINV,IDGT,WKAREA,IER,JWRITE)           PI    1
C                                                                       PI    2
C***  SUBROUTINE LPSDOR FIND THE PSEUDO-INVERSE OF A MATRIX             PI    3
C                                                                       PI    4
      DIMENSION A(IA,1),AINV(IA,1),WKAREA(M,1)                          PI    5
      REAL*8 A,AINV,WKAREA,BIGA,ANN,ZERO,ETA                            PI    6
      REAL*8 SUM,DETA                                                   PI    7
C                                                                       PI    8
C***  INITIALIZE IER                                                    PI    9
      IER=0                                                             PI   10
      MP1=M+1                                                           PI   11
      MP2=M+2                                                           PI   12
      MP3=M+3                                                           PI   13
C***  FIND THE LARGEST ELEMENT OF A                                     PI   14
      BIGA=0.D0                                                         PI   15
      DO 1 I=1,M                                                        PI   16
      DO 1 II=1,M                                                       PI   17
      IF (BIGA.GE.DABS(A(I,II))) GO TO 1                                PI   18
      BIGA=DABS(A(I,II))                                                PI   19
    1 CONTINUE                                                          PI   20
      ANN=M*N                                                           PI   21
      ETA=DSQRT(ANN)/(10.**IDGT)*BIGA                                   PI   22
C***  CALCULATE THE SINGULAR VALUE DECOMPOSITION OF A                   PI   23
      CALL LSVALB(A,M,M,IA,M,1,WKAREA(1,M+4),WKAREA(1,MP1),AINV,WKAREA) PI   24
      DO 2 I=1,M                                                        PI   25
    2 WKAREA(I,MP2)=WKAREA(I,MP1)                                       PI   26
C***  SORT THE SINGULAR VALUES ARRAY INTO ASCENDING SEQUENCE BY ABSOLUTE PI   27
C***  VALUE                                                             PI   28
      CALL VSORTH(WKAREA(1,MP2),M)                                      PI   29
      DETA=ETA**2                                                       PI   30
      CALL VXPZRO                                                       PI   31
C***  COMPARE SINGULAR VALUES AND ETA                                   PI   32
      DO 3 I=1,M                                                        PI   33
      IP=I                                                              PI   34
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      CALL VXPMUL(WKAREA(I,MP2),WKAREA(I,MP2))                          PI  35
      CALL VXPSTO(SUM)                                                  PI  36
      IF (SUM.GT.DETA) GO TO 4                                          PI  37
    3 CONTINUE                                                          PI  38
      IER=129                                                           PI  39
      GO TO 15                                                          PI  40
    4 IP=IP-1                                                           PI  41
      IF (IP.NE.0) GO TO 5                                              PI  42
      ZERO=0.D0                                                         PI  43
      GO TO 6                                                           PI  44
    5 ZERO=WKAREA(IP,MP2)                                               PI  45
    6 DO 10 I=1,N                                                       PI  46
      IF (WKAREA(I,MP1).LE.ZERO) GO TO 8                                PI  47
      DO 7 J=1,N                                                        PI  48
    7 WKAREA(J,I)=WKAREA(J,I)/WKAREA(I,MP1)                             PI  49
      GO TO 10                                                          PI  50
C***  SET WKAREA(J,I)=0.0, FOR J=1,...,N, IF WKAREA(I,MP1).LE.ZERO      PI  51
    8 DO 9 J=1,N                                                        PI  52
    9 WKAREA(J,I)=0.0                                                   PI  53
   10 CONTINUE                                                          PI  54
      DO 14 I=1,N                                                       PI  55
      DO 12 J=1,N                                                       PI  56
      CALL VXPZRO                                                       PI  57
      DO 11 K=1,N                                                       PI  58
   11 CALL VXPMUL(WKAREA(J,K),AINV(I,K))                                PI  59
      CALL VXPSTO(SUM)                                                  PI  60
   12 WKAREA(J,MP3)=SUM                                                 PI  61
C***  MOVE THE RESULTS INTO MATRIX AINV                                 PI  62
      DO 13 J=1,N                                                       PI  63
   13 AINV(I,J)=WKAREA(J,MP3)                                           PI  64
   14 CONTINUE                                                          PI  65
      GO TO 16                                                          PI  66
   15 CALL UERTST(IER,6HLPSDOM,JWRITE)                                  PI  67
   16 RETURN                                                            PI  68
      END                                                               PI  69


      SUBROUTINE LSVALR(A,M,N,IA,IV,ISW,WKAREA,Q,U,V)
C                                                                       SV   1
C***  SUBROUTINE LSVALR DETERMINES THE SINGULAR VALUE DECOMPOSITION OF A SV   2
C***  MATRIX                                                            SV   3
C                                                                       SV   4
      DIMENSION A(IA,1),U(IA,1),V(IV,1),Q(1),WKAREA(1)                  SV   5
      REAL*8A,WKAREA,Q,U,V,EPS,TOL                                      SV   6
      REAL*8F,G,H,X,Y,Z,C,S,HR,GR,DPS,ONE,ZERO                          SV   7
      DATA TOL/Z0010000000000000/,DPS/Z3410000000000000/                SV   8
      DATA ONE/1.0D0/,ZERO/0.0D0/                                       SV   9
C                                                                       SV  10
      EPS=DPS                                                           SV  11
      DO 1 I=1,N                                                        SV  12
      DO 1 J=1,N                                                        SV  13
      U(I,J)=A(I,J)                                                     SV  14
    1 CONTINUE                                                          SV  15
C***  HOUSEHOLDER'S REDUCTION TO BIDIAGONAL FORM                        SV  16
      X=0.D0                                                            SV  17
      G=0.D0                                                            SV  18
      DO 17 I=1,N                                                       SV  19
      WKAREA(I)=G                                                       SV  20
      CALL VXPZRO                                                       SV  21
                                                                        SV  22
      L=I+1                                                             SV  23
      DO 2 J=I,N                                                        SV  24
    2 CALL VXPMUL(U(J,I),U(J,I))                                        SV  25
      CALL VXPSTO(S)                                                    SV  26
      IF (S.GE.TOL) GO TO 3                                             SV  27
      G=0.D0                                                            SV  28
      GO TO 7                                                           SV  29
    3 F=U(I,I)                                                          SV  30
      G=-DSQRT(S)                                                       SV  31
      IF (F.LT.0.D0) G=-G                                               SV  32
      H=F*G-S                                                           SV  33
      HR=1.0/H                                                          SV  34
      U(I,I)=F-G                                                        SV  35
      IF (L.GT.N) GO TO 7                                               SV  36
      DO 6 J=L,N                                                        SV  37
      CALL VXPZRO                                                       SV  38
      DO 4 K=I,N                                                        SV  39
    4 CALL VXPMUL(U(K,I),U(K,J))                                        SV  40
      CALL VXPSTO(S)                                                    SV  41
      F=S*HR                                                            SV  42
      DO 5 K=I,N                                                        SV  43
    5 U(K,J)=U(K,J)+F*U(K,I)                                            SV  44
    6 CONTINUE                                                          SV  45
    7 Q(I)=G                                                            SV  46
      CALL VXPZRO                                                       SV  47
      IF (L.GT.N) GO TO 9                                               SV  48
      DO 8 J=L,N                                                        SV  49
    8 CALL VXPMUL(U(I,J),U(I,J))                                        SV  50
      CALL VXPSTO(S)                                                    SV  51
    9 IF (S.GE.TOL) GO TO 10                                            SV  52
      G=0.D0                                                            SV  53
      GO TO 16                                                          SV  54
   10 IF (I.LT.N) F=U(I,I+1)                                            SV  55
      G=-DSQRT(S)                                                       SV  56
      IF (F.LT.0.D0) G=-G                                               SV  57
      H=F*G-S                                                           SV  58
      HR=1.0/H                                                          SV  59
      IF (I.LT.N) U(I,I+1)=F-G                                          SV  60
      IF (L.GT.N) GO TO 12                                              SV  61
      DO 11 J=L,N                                                       SV  62
   11 WKAREA(J)=U(I,J)*HR                                               SV  63
   12 IF (L.GT.N) GO TO 16                                              SV  64
      DO 15 J=L,N                                                       SV  65
      CALL VXPZRO                                                       SV  66
      IF (L.GT.N) GO TO 15                                              SV  67
      DO 13 K=L,N                                                       SV  68
   13 CALL VXPMUL(U(J,K),U(I,K))                                        SV  69
      CALL VXPSTO(S)                                                    SV  70
      DO 14 K=L,N                                                       SV  71
   14 U(J,K)=U(J,K)+S*WKAREA(K)                                         SV  72
   15 CONTINUE                                                          SV  73
   16 Y=DABS(Q(I))+DABS(WKAREA(I))                                      SV  74
      IF (Y.GT.X) X=Y                                                   SV  75
   17 CONTINUE                                                          SV  76
C***  ACCUMULATION OF RIGHT HAND TRANSFORMATIONS                        SV  77
      IF (ISW.EQ.0) GO TO 37                                            SV  78
      DO 25 I=1,N                                                       SV  79
      II=N-I+1                                                          SV  80
      IF (G.EQ.0.D0) GO TO 22                                           SV  81
      IF (L.GT.N) GO TO 24                                              SV  82
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      H=U(II,II+1)*G                                                    SV   83
      HR=1.0/H                                                          SV   84
      DO 18 J=L,M                                                       SV   85
   18 V(J,II)=U(II,J)*HR                                                SV   86
      DO 21 J=L,M                                                       SV   87
      CALL VXPZRO                                                       SV   88
      DO 19 K=L,M                                                       SV   89
   19 CALL VXPMUL(U(II,K),V(K,J))                                       SV   90
      CALL VXPSTO(S)                                                    SV   91
      DO 20 K=L,M                                                       SV   92
   20 V(K,J)=V(K,J)+S*V(K,II)                                           SV   93
   21 CONTINUE                                                          SV   94
   22 IF (L.GT.M) GO TO 24                                              SV   95
      DO 23 J=L,M                                                       SV   96
      V(J,II)=0.DO                                                      SV   97
   23 V(II,J)=0.DO                                                      SV   98
   24 V(II,II)=1.0DO                                                    SV   99
      G=WKAREA(II)                                                      SV  100
   25 L=II                                                              SV  101
C***  ACCUMULATION OF LEFT HAND TRANSFORMATIONS                         SV  102
      DO 36 I=1,M                                                       SV  103
      II=M-I+1                                                          SV  104
      LL=II+1                                                           SV  105
      G=Q(II)                                                           SV  106
      IF (LL.GT.M) GO TO 27                                             SV  107
      DO 26 J=LL,M                                                      SV  108
   26 U(II,J)=0.DO                                                      SV  109
   27 IF (G.EQ.0.DO) GO TO 33                                           SV  110
      H=U(II,II)*G                                                      SV  111
      HR=1.0/H                                                          SV  112
      IF (LL.GT.M) GO TO 31                                             SV  113
      DO 30 J=LL,M                                                      SV  114
      CALL VXPZRO                                                       SV  115
      DO 28 K=LL,M                                                      SV  116
   28 CALL VXPMUL(U(K,II),U(K,J))                                       SV  117
      CALL VXPSTO(S)                                                    SV  118
      F=S*HR                                                            SV  119
      DO 29 K=II,M                                                      SV  120
   29 U(K,J)=U(K,J)+F*U(K,II)                                           SV  121
   30 CONTINUE                                                          SV  122
   31 GR=1.0/G                                                          SV  123
      DO 32 J=II,M                                                      SV  124
   32 U(J,II)=U(J,II)*GR                                                SV  125
      GO TO 35                                                          SV  126
   33 DO 34 J=II,M                                                      SV  127
   34 U(J,II)=0.DO                                                      SV  128
   35 U(II,II)=U(II,II)+1.0DO                                           SV  129
   36 CONTINUE                                                          SV  130
C***  DIAGONALIZATION OF THE BIDIAGONAL FORM                            SV  131
   37 EPS=EPS*X                                                         SV  132
      DO 57 K=1,M                                                       SV  133
      KK=M-K+1                                                          SV  134
C***  TEST F SPLITTING                                                  SV  135
   38 DO 39 L=1,KK                                                      SV  136
      LL=KK-L+1                                                         SV  137
      IF (DABS(WKAREA(LL)).LE.EPS) GO TO 45                             SV  138
      IF (LL.EQ.1) GO TO 45                                             SV  139
      IF (DABS(Q(LL-1)).LE.EPS) GO TO 40                                SV  140
   39 CONTINUE                                                          SV  141
C***  CANCELLATION OF WKAREA(L) IF LL.GT.1                              SV  142
   40 C=0.DO                                                            SV  143
      S=1.0DO                                                           SV  144
      L1=LL-1                                                           SV  145
      IF (KK.LT.LL) GO TO 45                                            SV  146
      DO 44 I=LL,KK                                                     SV  147
      F=S*WKAREA(I)                                                     SV  148
      WKAREA(I)=C*WKAREA(I)                                             SV  149
      IF (DABS(F).LE.EPS) GO TO 45                                      SV  150
      G=Q(I)                                                            SV  151
      Q(I)=DSQRT(F*F+G*G)                                               SV  152
      H=Q(I)                                                            SV  153
      IF (H.NE.ZERO) GO TO 41                                           SV  154
      C=ZERO                                                            SV  155
      S=ONE                                                             SV  156
      GO TO 42                                                          SV  157
   41 C=G/H                                                             SV  158
      S=-F/H                                                            SV  159
   42 IF (ISW.EQ.0) GO TO 44                                            SV  160
      DO 43 J=1,M                                                       SV  161
      Y=U(J,L1)                                                         SV  162
      Z=U(J,I)                                                          SV  163
      U(J,L1)=Y*C+Z*S                                                   SV  164
   43 U(J,I)=-Y*S+Z*C                                                   SV  165
   44 CONTINUE                                                          SV  166
C***  TEST F CONVERGENCE                                                SV  167
   45 Z=Q(KK)                                                           SV  168
      IF (LL.EQ.KK) GO TO 55                                            SV  169
C***  SHIFT FROM BOTTOM 2X2 MINOR                                       SV  170
      X=Q(LL)                                                           SV  171
      IF (KK.GT.1) Y=Q(KK-1)                                            SV  172
      IF (KK.GT.1) G=WKAREA(KK-1)                                       SV  173
      H=WKAREA(KK)                                                      SV  174
      F=((Y-Z)*(Y+Z)+(G-H)*(G+H))/(2.DO*H*Y)                            SV  175
      G=DSQRT(F*F+ONE)                                                  SV  176
      IF (F.LT.0.DO) F=((X-Z)*(X+Z)+H*(Y/(F-G)-H))/X                    SV  177
      IF (F.GE.0.DO) F=((X-Z)*(X+Z)+H*(Y/(F+G)-H))/X                    SV  178
C***  NEXT QR TRANSFORMATION                                            SV  179
      C=1.0DO                                                           SV  180
      S=1.0DO                                                           SV  181
      L2=LL+1                                                           SV  182
      IF (KK.LT.L2) GO TO 54                                            SV  183
      DO 53 I=L2,KK                                                     SV  184
      G=WKAREA(I)                                                       SV  185
      Y=Q(I)                                                            SV  186
      H=S*G                                                             SV  187
      G=C*G                                                             SV  188
      Z=DSQRT(F*F+H*H)                                                  SV  189
      WKAREA(I-1)=Z                                                     SV  190
      IF (Z.NE.ZERO) GO TO 46                                           SV  191
      C=ZERO                                                            SV  192
      S=ONE                                                             SV  193
      GO TO 47                                                          SV  194
   46 C=F/Z                                                             SV  195
      S=H/Z                                                             SV  196
   47 F=X*C+G*S                                                         SV  197
      G=-X*S+G*C                                                        SV  198
      H=Y*S                                                             SV  199
      Y=Y*C                                                             SV  200
      IF (ISW.EQ.0) GO TO 49                                            SV  201
      DO 48 J=1,M                                                       SV  202
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      X=V(J,I-1)                                                        SV  203
      Z=V(J,I)                                                          SV  204
      V(J,I-1)=X*C+Z*S                                                  SV  205
   48 V(J,I)=-X*S+Z*C                                                   SV  206
   49 Z=DSQRT(F*F+H*H)                                                  SV  207
      Q(I-1)=Z                                                          SV  208
      IF (Z.NE.ZERO) GO TO 50                                           SV  209
      C=ZERO                                                            SV  210
      S=ONE                                                             SV  211
      GO TO 51                                                          SV  212
   50 C=F/Z                                                             SV  213
      S=H/Z                                                             SV  214
   51 F=C*G+S*Y                                                         SV  215
      X=-S*G+C*Y                                                        SV  216
      IF (ISW.EQ.0) GO TO 53                                            SV  217
      DO 52 J=1,M                                                       SV  218
      Y=U(J,I-1)                                                        SV  219
      Z=U(J,I)                                                          SV  220
      U(J,I-1)=Y*C+Z*S                                                  SV  221
   52 U(J,I)=-Y*S+Z*C                                                   SV  222
   53 CONTINUE                                                          SV  223
   54 WKAREA(LL)=ZERO                                                   SV  224
      WKAREA(KK)=F                                                      SV  225
      Q(KK)=X                                                           SV  226
      GO TO 38                                                          SV  227
C***  CONVERGENCE                                                       SV  228
   55 IF (Z.GE.ZERO) GO TO 57                                           SV  229
      Q(KK)=-Z                                                          SV  230
      IF (ISW.EQ.0) GO TO 57                                            SV  231
      DO 56 J=1,M                                                       SV  232
   56 V(J,KK)=-V(J,KK)                                                  SV  233
   57 CONTINUE                                                          SV  234
      RETURN                                                            SV  235
      END                                                               SV  23o



      SUBROUTINE UERTST(IER,NAME,JWRITE)                                UR    1
C                                                                       UR    2
C***  SUBROUTINE UERTST GENERATES ERROR MESSAGES                        UR    3
C                                                                       UR    4
      DIMENSION ITYP(5,4),IBIT(4)                                       UR    5
      INTEGER*2 NAME(3)                                                 UR    6
      INTEGER WARN,WARF,IERR,JWRITE                                     UR    7
      EQUIVALENCE (IBIT(1),WARN),(IBIT(2),WARF),(IBIT(3),TERM)          UR    8
      DATA ITYP/'WARN','ING ',' ',' ',' ','WARN','ING(','WITH',         UR    9
     1' FIX',')  ','TERM','INAL',' ',' ',' ','NON-','DEFI','NE         UR   10
     1D ',' ',' ','/,IBIT/32,64,128,0/                                  UR   11
C                                                                       UR   12
      IER2=IER                                                          UR   13
      IF (IER2.GE.WARN) GO TO 1                                         UR   14
C***  UNDEFINED                                                         UR   15
      IER1=4                                                            UR   16
      GO TO 4                                                           UR   17
    1 IF (IER2.LT.TERM) GO TO 2                                         UR   18
C***  TERMINAL                                                          UR   19
      IER1=3                                                            UR   20
      GO TO 4                                                           UR   21
    2 IF (IER2.LT.WARF) GO TO 3                                         UR   22
C***  WARNING (WITH FIX)                                                UR   23
      IER1=2                                                            UR   24
      GO TO 4                                                           UR   25
C***  WARNING                                                           UR   26
    3 IER1=1                                                            UR   27
C***  EXTRACT 'N'                                                       UR   28
    4 IER2=IER2-IBIT(IER1)                                              UR   29
C***  PRINT ERROR MESSAGE                                               UR   30
      WWRITE (JWRITE,5) (ITYP(I,IER1),I=1,5),NAME,IER2,IER              UR   31
    5 FORMAT (1X,/,1X,'ERROR MESSAGE FROM UERTST',2X,5A4,4X,3A2,4X,I2,2X UR   32
     1,'IER= ',I3)                                                      UR   33
      RETURN                                                            UR   34
      END                                                               UR   35



      SUBROUTINE VSORTN(A,LA)                                           VS    1
C                                                                       VS    2
C***  SUBROUTINE VSORTN SORTS ARRAYS BY ABSOLUTE VALUE                  VS    3
C                                                                       VS    4
      DIMENSION A(1),IU(21),IL(21)                                      VS    5
      REAL*8A,T,TT                                                      VS    6
C                                                                       VS    7
C***  FIND ABSOLUTE VALUES OF ARRAY A                                   VS    8
      DO 1 I=1,LA                                                       VS    9
      IF (A(I).LT.0.0)A(I)=-A(I)                                        VS   10
    1 CONTINUE                                                          VS   11
C                                                                       VS   12
      ENTRY VSORTA(A,LA)                                                VS   13
C                                                                       VS   14
C***  ENTRY VSORTA SORTS ARRAYS BY ALGEBRAIC VALUE                      VS   15
C                                                                       VS   16
      M=1                                                               VS   17
      I=1                                                               VS   18
      J=LA                                                              VS   19
      R=.375                                                            VS   20
    2 IF (I.EQ.J) GO TO 11                                              VS   21
      IF (R.GT..5898437) GO TO 4                                        VS   22
      R=R+3.90625E-2                                                    VS   23
      GO TO 5                                                           VS   24
    4 R=R-.21875                                                        VS   25
    5 K=I                                                               VS   26
C***  SELECT A CENTRAL ELEMENT OF THE ARRAY AND SAVE IT IN LOCATION T   VS   27
      IJ=I+(J-I)*R                                                      VS   28
      T=A(IJ)                                                           VS   29
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAT T, INTERCHANGE WITH T   VS   30
      IF (A(I).LE.T) GO TO 6                                            VS   31
      A(IJ)=A(I)                                                        VS   32
      A(I)=T                                                            VS   33
      T=A(IJ)                                                           VS   34
    6 L=J                                                               VS   35
C***  IF LAST ELEMENT OF ARRAY IS LESS THAN T, INTERCHANGE WITH T       VS   36
      IF (A(J).GE.T) GO TO 8                                            VS   37
      A(IJ)=A(J)                                                        VS   38
      A(J)=T                                                            VS   39
      T=A(IJ)                                                           VS   40
C***  IF FIRST ELEMENT OF ARRAY IS GREATER THAN T, INTERCHANGE WITH T   VS   41
      IF (A(I).LE.T) GO TO 8                                            VS   42
      A(IJ)=A(I)                                                        VS   43
      A(I)=T                                                            VS   44
      T=A(IJ)                                                           VS   45
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      GO TO 8                                                           VS   46
    7 TT=A(L)                                                           VS   47
      A(L)=A(K)                                                         VS   48
      A(K)=TT                                                           VS   49
C***  FIND AN ELEMENT IN SECOND HALF OF ARRAY WHICH IS SMALLER THAN T   VS   50
      L=L-1                                                             VS   51
      IF (A(L).GT.T) GO TO 8                                            VS   52
C***  FIND AN ELEMENT IN FIRST HALF OF ARRAY WHICH IS GREATER THAN T     VS   53
    9 K=K+1                                                             VS   54
      IF (A(K).LT.T) GO TO 9                                            VS   55
C***  INTERCHANGE THESE ELEMENTS                                        VS   56
      IF (K.LE.L) GO TO 7                                               VS   57
C***  SAVE UPPER AND LOWER SUBSCRIPTS OF THE ARRAY YET TO BE SORTED     VS   58
      IF (L-I.LE.J-K) GO TO 10                                          VS   59
      IL(M)=I                                                           VS   60
      IU(M)=L                                                           VS   61
      I=K                                                               VS   62
      M=M+1                                                             VS   63
      GO TO 12                                                          VS   64
   10 IL(M)=K                                                           VS   65
      IU(M)=J                                                           VS   66
      J=L                                                               VS   67
      M=M+1                                                             VS   68
      GO TO 12                                                          VS   69
C***  BEGIN AGAIN ON ANOTHER PORTION OF UNSORTED ARRAY                  VS   70
   11 M=M-1                                                             VS   71
      IF (M.EQ.0) RETURN                                                VS   72
      I=IL(M)                                                           VS   73
      J=IU(M)                                                           VS   74
   12 IF (J-I.GE.11) GO TO 5                                            VS   75
      IF (I.EQ.1) GO TO 2                                               VS   76
      I=I-1                                                             VS   77
   13 I=I+1                                                             VS   78
      IF (I.EQ.J) GO TO 11                                              VS   79
      T=A(I+1)                                                          VS   80
      IF (A(I).LE.T) GO TO 13                                           VS   81
      K=I                                                               VS   82
   14 A(K+1)=A(K)                                                       VS   83
      K=K-1                                                             VS   84
      IF (T.LT.A(K)) GO TO 14                                           VS   85
      A(K+1)=T                                                          VS   86
      GO TO 13                                                          VS   87
      END                                                               VS   88



      SUBROUTINE HPATH(N,F,NNB,LPRG,FIT,TABL,HTABL,NHPI)                HP    1
C                                                                       HP    2
C***  SUBROUTINE HPATH CONTROLS THE TRAJECTORY PREDICTION ROUTINES AND   HP    3
C***  PERFORMS AN ITERATIVE SCHEME TO ATTEMPT AN IMPROVEMENT IN THE     HP    4
C***  POWER, LIFT, AND DRAG COEFFICIENTS                                HP    5
C                                                                       HP    6
      IMPLICIT REAL*8(A-H,O-Z)                                          HP    7
      EXTERNAL VA,DDV,DDDV,ALP,DVA,PHIDER                               HP    8
      DIMENSION TB(101),WW(450),FIT(2),HLD(3,450),FS(13),RX(169),CC(13), HP    9
     1DCX(13),CK(6),WK(6,13),TWJ(13),TOL(6),RS(169),TWKK(169),N(6),PAC(8 HP   10
     1),C(450,11),Z(450,9),WKAR(250),CFN(14),SGN(4),SGD(4),FT1(450),FT2( HP   11
     1),ILOC(13),COST(20),U(13,13),Y(13,1),ENER(3),SNN(4),CTP(7),JLOC(13 HP   12
     1),LLOC(13),PS(13),DP(6),XW(6),AA(4,450),RR(169),TWK(169),RP(169),Z HP   13
     1K(13,13),ZL(13,14),RQ(169),WGTL(13),WGTU(13),RXS(169),CCX(13),RWT( HP   14
     113,2),ZR(13,13),TWKX(169),YS(13,1),SCALE(13),DSL(13),NLOC(13),XHLD HP   15
     1(3,450),HCFN(11,13),SF(13)                                        HP   16
      COMMON TIME(450),F1(450),F2(450),F3(450),F4(450),F5(450),F6(450),F HP   17
     17(450),F8(450),F9(450),F10(450),F11(450),F12(450),F13(450),F14(450 HP   18
     1),C(450,11),Z(450,9),WKAR(250),CFN(14),SGN(4),SGD(4),FT1(450),FT2( HP   19
     1450),PHRA(450),SS(450),ST(450),SU(450),SV(450),EX1,EX2,EX3,EX4,G,S HP   20
     1,RHO,TIA,EXPX,FLOW,PHIGH,CDLOW,CDHIGH,JREAD,JWRITE,JPUNCH,IEX1,IEX HP   21
     12,IEX3,IEX4,METRIC,L1,L2,IEQNN(18),IERR                           HP   22
      COMMON /LAB1/AP(13),WGT(13),CMMIN(13),CMMAX(13)                   HP   23
      COMMON /LAB2/YCPT,ICD,MTH,MCLCC                                   HP   24
      COMMON /TEST/ICKP                                                 HP   25
      COMMON /LAB7/A,R,W,R1                                             HP   26
      COMMON /LAB3/DGAM                                                 HP   27
      COMMON /LAB4/XRHO                                                 HP   28
      COMMON /LAB5/GMX,DGMX,D2GM,D3GM                                   HP   29
      COMMON /LAB6/T1,ADT                                               HP   30
      COMMON /LABX/IWRITE,IERR                                          HP   31
      DATA WGTL/1.0D+1,0.0D+0,5.0D+1,1.0D+3,0.0D+0,1.0D+5,0.0D+0,8.0D+2, HP   32
     10.0D+0,3.0D-4,0.0D+0,5.0D+0,1.0D+2/,WGTU/1.0D+1,6.0D+6,5.0D+1,9.0D HP   33
     1+3,0.0D+0,1.0D+5,9.0D+0,5.0D+1,0.0D+0,1.0D+5,0.0D+0,1.0D+2,1.0D+6/ HP   34
     1,SCALE/1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0 HP   35
     1D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0,1.0D+0/,DF/1.0D+4,1.0D+1,1.5D-1,1.0D+0,1. HP   36
     16D+4,0.0D+0/                                                      HP   37
C                                                                       HP   38
C***  SET SUBROUTINE PARAMETERS                                         HP   39
      NEQ=13                                                            HP   40
      FKK=1.0D0                                                         HP   41
C***  INITIALIZE PARAMETERS                                             HP   42
      IWRITE=JWRITE                                                     HP   43
      IERR=IERR                                                         HP   44
      IX1=IEX1-1                                                        HP   45
      IX2=IEX2-1                                                        HP   46
      IX3=IEX3-1                                                        HP   47
      IX4=IEX4-1                                                        HP   48
      IXX1=IX1-1                                                        HP   49
      IXX2=IX2-1                                                        HP   50
      IXX3=IX3-1                                                        HP   51
      IXX4=IX4-1                                                        HP   52
      CALL CHNGE(SNN)                                                   HP   53
      CALL CHNGE(SGN)                                                   HP   54
      CALL CHNGE(SGD)                                                   HP   55
C***  ENACT SPLINES ON AIRSPEED AND ACCELERATION FOR INTERPOLATION      HP   56
      CALL SPLINE(N,F4,TIME,AA,1)                                       HP   57
      CALL SPLINE(N,F8,TIME,AA,2)                                       HP   58
      DO 1 JKP=1,N                                                      HP   59
    1 WW(JKP)=DDV(TIME(JKP))                                            HP   60
      CALL SPLINE(N,WW,TIME,AA,4)                                       HP   61
C***  CALCULATE NUMBER OF MATRIX ELEMENTS                               HP   62
      NUM=NEQ                                                           HP   63
      NKD=NEQ*NEQ                                                       HP   64
C***  DETERMINE NUMBER OF VALID NONZERO COEFFICIENTS                    HP   65
      DO 2 I=1,NEQ                                                      HP   66
      IF (CFN(I).EQ.0.0D0)NUM=NUM-1                                     HP   67
      HCFN(1,I)=CFN(I)                                                  HP   68
    2 JLCC(I)=0                                                         HP   69
C***  BEGIN HPATH ITERATION LOOP                                        HP   70
      IPS=0                                                             HP   71
      LKK=0                                                             HP   72
      JK=0                                                              HP   73
    3 JK=JK+1                                                           HP   74
      IKK=LKK+1
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      IF(JK.GT.NHPI.OR.LKK.GT.NHPI) GO TO 133                          MP  75
      IF (LKK.EQ.1) GO TO 5                                            MP  76
      DO 4 LL=1,NEQ                                                    MP  77
      CRHIN(LL)=CRHIN(LL)*1.0000018D0                                  MP  78
    4 CRHAX(LL)=CRHAX(LL)/1.0000018D0                                  MP  79
    5 WRITE (JWRITE,6) LKK                                             MP  80
    6 FORMAT (1H,///,33X,65HF L I G H T   P A T H   T R A J E C T O R Y  MP  81
     1  P R E D I C T I O N,//,59X,11HITERATION #,I2,//,5X,'TIME',7X,'AL MP  82
     1TITUDE',5X,'AIRSPEED',4X,'FLIGHT PATH',3X,'ANGLE OF',7X,'LIFT',9X, MP  83
     1'DRAG',8X,'WEIGHT',8X,'POWER',5X,'ACCELERATION',/,44X,'ANGLE',7X,' MP  84
     1ATTACK',5X,'COEFFICIENT',2X,'COEFFICIENT',16X,'AVAILABLE')       MP  85
      IF (METRIC.NE.0) GO TO 8                                         MP  86
      WRITE (JWRITE,7)                                                 MP  87
    7 FORMAT (4X,'(SEC)',9X,'(FT)',7X,'(FT/SEC)',5X,'(RADIAN)',5X,'(RADI MP  88
     1AN)',33X,'(LBF)',5X,'(FT-LBF/SEC)',3X,'(FT/SEC)',/)              MP  89
      GO TO 10                                                         MP  90
    8 WRITE (JWRITE,9)                                                 MP  91
    9 FORMAT (4X,'(SEC)',9X,'(M)',9X,'(M/SEC)',5X,'(RADIAN)',5X,'(RADIAN MP  92
     1)',32X,'(NEWTONS)',5X,'(KW)',9X,'(M/SEC)',/)                    MP  93
C***  INITIALIZE PARAMETERS                                            MP  94
   10 DO 11 LL=1,3                                                     MP  95
   11 ERRE(LL)=0.0D0                                                   MP  96
      NCd=0                                                            MP  97
      LCN=0                                                            MP  98
      IPTS=99                                                          MP  99
      N=N*(N-1)*IPTS                                                   MP 100
      ICKP=0                                                           MP 101
      ADT=0.0D0                                                        MP 102
      DO 12 LL=1,13                                                    MP 103
      RWT(LL,1)=0.0D0                                                  MP 104
      RWT(LL,2)=0.0D0                                                  MP 105
   12 SK(5,LL)=0.0D0                                                   MP 106
      KPRINT=0                                                         MP 107
C***  CALCULATE MAXIMUMS FOR WEIGHTS                                   MP 108
      XW(1)=F10(1)                                                     MP 109
      XW(2)=DABS(DARSIN(F11(1)/F4(1)))                                 MP 110
      XW(3)=DABS(FT2(1))                                               MP 111
      XW(4)=F1(1)                                                      MP 112
      XW(5)=F4(1)**2/(2.0D0*G)+F10(1)                                  MP 113
      XW(6)=DABS(F6(1))                                                MP 114
      DO 13 JKP=2,N                                                    MP 115
      IF (F10(JKP).GT.XW(1)) XW(1)=F10(JKP)                            MP 116
      IF (DABS(DARSIN(F11(JKP)/F4(JKP))).GT.XW(2)) XW(2)=DABS(DARSIN(F11( MP 117
     1JKP)/F4(JKP)))                                                   MP 118
      IF (DABS(FT2(JKP)).GT.XW(3)) XW(3)=DABS(FT2(JKP))                MP 119
      IF (F1(JKP).GT.XW(4)) XW(4)=F1(JKP)                              MP 120
      IF ((F4(JKP)**2/(2.0D0*G)+F10(JKP)).GT.XW(5)) XW(5)=F4(JKP)**2/(2.0 MP 121
     1D0*G)+F10(JKP)                                                   MP 122
   13 IF (DABS(F6(JKP)).GT.XW(6)) XW(6)=DABS(F6(JKP))                  MP 123
C***  CALCULATE WEIGHTS FOR LEAST SQUARES SOLUTION                     MP 124
      DO 14 I=1,6                                                      MP 125
   14 D(I)=DF(I)/XW(I)**2                                              MP 126
C***  EXACT SPLINE ON ANGLE OF ATTACK FOR ROOT ESTIMATIONS             MP 127
      CALL SPLINE(N,F6,TIME,AA,3)                                      MP 128
C***  EXACT POLYNOMIAL FIT ROUTINE ON WEIGHT                           MP 129
      CALL WSUB(N,F1,TIME,WB)                                          MP 130
C***  SET INITIAL VALUES                                               MP 131
      TH(1)=TIME(1)                                                    MP 132
      L=1                                                              MP 133
      LC=1                                                             MP 134
      I1=L                                                             MP 135
      I1S=I1                                                           MP 136
      J=0                                                              MP 137
      ISET=0                                                           MP 138
      DO 15 JKP=1,6                                                    MP 139
   15 TOL(JKP)=0.0D0                                                   MP 140
C***  BEGIN ANALYSIS ON SET OF POINTS                                  MP 141
      DO 88 IPT=2,N                                                    MP 142
      IPTS=9                                                           MP 143
      IF (IPT.EQ.2)IPTS=32                                             MP 144
      IF (ICKP.NE.0)IPTS=19                                            MP 145
      M=1                                                              MP 146
      IF (IPTS.EQ.0)M=0                                                MP 147
      ICKP=0                                                           MP 148
      IPTSP1=IPTS+1                                                    MP 149
      K=K-(99-IPTS)                                                    MP 150
      IF (IPT.LE.2) GO TO 16                                           MP 151
      TS=TH(L-1)                                                       MP 152
      TFPT=TH(1)                                                       MP 153
      TH(1)=TTH                                                        MP 154
      L=1                                                              MP 155
      I1=I1S                                                           MP 156
   16 DELT=(TIME(IPT)-TIME(IPT-1))/IPTSP1                              MP 157
C***  COMPUTE TIME POINTS BETWEEN INPUT TIME POINTS                    MP 158
      DO 17 JK=1,IPTSP1                                                MP 159
      L=L+1                                                            MP 160
      LC=LC+1                                                          MP 161
   17 TH(L)=TH(L-1)+DELT                                               MP 162
      TH(L)=TIME(IPT)                                                  MP 163
      TTH=TH(L)                                                        MP 164
C***  DETERMINE INTERVAL RANGE                                         MP 165
      I2=LC                                                            MP 166
      I1S=I2                                                           MP 167
      I4=I2-1                                                          MP 168
      IF (I2.EQ.K)I4=I2                                                MP 169
C***  BEGIN ANALYSIS ON INTERVAL RANGE                                 MP 170
      DO 87 I=I1,I4                                                    MP 171
      IF (I.NE.1)AS=AF                                                 MP 172
      T=TH(I-I1+1)                                                     MP 173
      V=VA(T)                                                          MP 174
      DV=DVA(T)                                                        MP 175
      IF (I.NE.1.AND.KPRINT.EQ.N)AT=A                                  MP 176
      A=ALP(T)                                                         MP 177
      IF (I.NE.1) GO TO 18                                             MP 178
C***  DETERMINE PARAMETERS FOR FIRST POINT                             MP 179
      W=F1(I)                                                          MP 180
      R=F5(I)                                                          MP 181
      GFPA=DARSIN(F11(I)/F4(I))                                        MP 182
      GFPA=GFPA+TARE                                                   MP 183
      H=F10(I)+HTARE                                                   MP 184
      T1=0.0D0                                                         MP 185
      R1=R                                                             MP 186
      THT1=T-T1                                                        MP 187
      GO TO 20                                                         MP 188
C***  DETERMINE PREVIOUS TIME POINT VALUE                              MP 189
   18 IF (I.EQ.I1)T1=TS                                                MP 190
      IF (I.NE.I1)T1=TH(I-I1)                                          MP 191
C***  DETERMINE VALUES AT PREVIOUS TIME POINT                          MP 192
      Z=I1                                                             MP 193
      V=VA(Z)                                                          MP 194
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C-6

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      DV=DVA(Z)                                                          HP  195
      V2=DDV(Z)                                                          HP  196
      V3=DDDV(Z)                                                         HP  197
      P=CFM(1)*CFM(2)*V**EX1+CFM(3)*V**EX2+CFM(4)*V**EX3+CFM(5)*V**EX4   HP  198
C***  COMPUTE WEIGHT DERIVATIVES                                         HP  199
      DW=-F*P                                                            HP  200
      D2W=-F*DV*(EX1*CFM(2)*V**(EX1-1.0D0)+EX2*CFM(3)*V**(EX2-1.0D0)*EX3  HP  201
     1*CFM(4)*V**(EX3-1.0D0)+EX4*CFM(5)*V**(EX4-1.0D0))                  HP  202
      D3W=-F*(DV**2*(EX1*CFM(2)*(EX1-1.0D0)*V**(EX1-2.0D0)*EX2*CFM(3)*(E  HP  203
     1X2-1.0D0)*V**(EX2-2.0D0)*EX3*CFM(4)*(EX3-1.0D0)*V**(EX3-2.0D0)*EX4  HP  204
     1*CFM(5)*(EX4-1.0D0)*V**(EX4-2.0D0))+V2*(EX1*CFM(2)*V**(EX1-1.0D0)*  HP  205
     1EX2*CFM(3)*V**(EX2-1.0D0)*EX3*CFM(4)*V**(EX3-1.0D0)*EX4*CFM(5)*V**  HP  206
     1(EX4-1.0D0)))                                                      HP  207
      D4W=-F*((EX1*CFM(2)*(EX1-1.0D0)*(EX1-2.0D0)*V**(EX1-3.0D0)*EX2*CFM  HP  208
     1(3)*(EX2-1.0D0)*(EX2-2.0D0)*V**(EX2-3.0D0)*EX3*CFM(4)*(EX3-1.0D0)*  HP  209
     1(EX3-2.0D0)*V**(EX3-3.0D0)*EX4*CFM(5)*(EX4-1.0D0)*(EX4-2.0D0)*V**(  HP  210
     1EX4-3.0D0))*DV**3+3.0D0*DV*V2*(EX1*CFM(2)*(EX1-1.0D0)*V**(EX1-2.0D  HP  211
     10)*EX2*CFM(3)*(EX2-1.0D0)*V**(EX2-2.0D0)*EX3*CFM(4)*(EX3-1.0D0)*V*  HP  212
     1*(EX3-2.0D0)*EX4*CFM(5)*(EX4-1.0D0)*V**(EX4-2.0D0))+V3*(EX1*CFM(2)*  HP  213
     1V**(EX1-1.0D0)*EX2*CFM(3)*V**(EX2-1.0D0)*EX3*CFM(4)*V**(EX3-1.0D0)  HP  214
     1*EX4*CFM(5)*V**(EX4-1.0D0)))                                       HP  215
C***  TEST FOR PARAMETERS' UPDATE                                        HP  216
      TMT1=T-T1                                                          HP  217
      IF (KPRINT.NE.H) GO TO 19                                          HP  218
      WT=W                                                               HP  219
      HT=H                                                               HP  220
      FPA=GMX                                                            HP  221
      DFPA=DGMX                                                          HP  222
C***  ESTIMATE WEIGHT, ALTITUDE, AND DENSITY AT NEXT POINT               HP  223
   19 W=W+TMT1*(DW+TMT1*(D2W/2.0D0+TMT1*(D3W/6.0D0+TMT1*D4W/24.0D0)))    HP  224
      DH=V*DSIN(GMX)                                                     HP  225
      D2H=DV*DSIN(GMX)+DGMX*V*DCOS(GMX)                                  HP  226
      D3H=(V2-V*DGMX*DGMX)*DSIN(GMX)+(2.0D0*DV*DGMX+V*D2GM)*DCOS(GMX)    HP  227
      D4H=(V3-3.0D0*V*DGMX*D2GM-3.0D0*DV*DGMX**2)*DSIN(GMX)+(3.0D0*V2*DG  HP  228
     1MX-V*DGMX**3+3.0D0*DV*D2GM+V*D3GM)*DCOS(GMX)                       HP  229
      IF (I.LE.7) D4H=0.0D0                                              HP  230
      H=H+TMT1*(DH+TMT1*(D2H/2.0D0+TMT1*(D3H/6.0D0+TMT1*D4H/24.0D0)))    HP  231
      R1=R                                                               HP  232
      R=RHO*(1.0D0-6.86D-6*H)**4.26D0                                    HP  233
      V=VA(T)                                                            HP  234
      DV=DVA(T)                                                          HP  235
C***  COMPUTE POWER                                                      HP  236
   20 P=CFM(1)*CFM(2)*V**EX1*CFM(3)*V**EX2+CFM(4)*V**EX3+CFM(5)*V**EX4   HP  237
      ICK=0                                                              HP  238
   21 ICK=ICK+1                                                          HP  239
C***  COMPUTE DRAG COEFFICIENT AND DERIVATIVES WRT ANGLE OF ATTACK       HP  240
      AM=DABS(A)                                                         HP  241
      IF (A.GE.0.0D0) GO TO 22                                           HP  242
      CALL SIGNS(SNM,IEX1,IEX2,IEX3,IEX4)                                HP  243
      CALL SIGNS(SGM,IX1,IX2,IX3,IX4)                                    HP  244
      CALL SIGNS(SGD,IXX1,IXX2,IXX3,IXX4)                                HP  245
   22 CD=CFM(6)+SNM(1)*CFM(7)*AM**IEX1+SNM(2)*CFM(8)*AM**IEX2+SNM(3)*CFM  HP  246
     1(9)*AM**IEX3+SNM(4)*CFM(10)*AM**IEX4                               HP  247
      CDP=SGM(1)*IEX1*CFM(7)*AM**IX1+SGM(2)*IEX2*CFM(8)*AM**IX2+SGM(3)*I  HP  248
     1EX3*CFM(9)*AM**IX3+SGM(4)*IEX4*CFM(10)*AM**IX4                     HP  249
      CDPP=SGD(1)*IEX1*IX1*CFM(7)*AM**IXX1+SGD(2)*IEX2*IX2*CFM(8)*AM**IX  HP  250
     1X2+SGD(3)*IEX3*IX3*CFM(9)*AM**IXX3+SGD(4)*IEX4*IX4*CFM(10)*AM**IXX  HP  251
     14                                                                  HP  252
      IF (A.GE.0.0D0) GO TO 23                                           HP  253
      CALL CHNGE(SNM)                                                    HP  254
      CALL CHNGE(SGM)                                                    HP  255
      CALL CHNGE(SGD)                                                    HP  256
C***  PERFORM NEWTON-RAPHSON TO DETERMINE 'ESTIMATED' ANGLE OF ATTACK    HP  257
   23 FA=DCOS(A+TIA)*P/(W*V)-(R*S*V*V*CD/(2.0D0*W)+DV/G*DSIN(GFPA))      HP  258
      FAP=-(DSIN(A+TIA)*P/(W*V)+R*S*V*V*CDP/(2.0D0*W))                   HP  259
      FAPP=-(DCOS(A+TIA)*P/(W*V)+R*S*V*V*CDPP/(2.0D0*W))                 HP  260
      RAD=(FAP/FAPP)*(FAP/FAPP)-2.0DC*(FA/FAPP)                          HP  261
      A1=A                                                               HP  262
      IF (RAD.LT.0.0D0) GO TO 25                                         HP  263
      IF ((FAP*FAPP).LT.0.0D0) GO TO 24                                  HP  264
      A=A-FAP/FAPP+DSQRT(RAD)                                            HP  265
      GO TO 26                                                           HP  266
   24 A=A-FAP/FAPP-DSQRT(RAD)                                            HP  267
      GO TO 26                                                           HP  268
   25 A=AS*0.26D0*ADT*TMT1                                               HP  269
      ICR=ICR+1                                                          HP  270
      GO TO 27                                                           HP  271
   26 IF (DABS(A1-A).LT.1.0D-15.OR.ICK.EQ.20) GO TO 27                   HP  272
      GO TO 21                                                           HP  273
C***  COMPUTE LIFT COEFFICIENT FOR 'ESTIMATED' ANGLE OF ATTACK           HP  274
   27 TDAPX=((I-I1)*F3(IPT)+(I4-I)*F3(IPT-1))/(I4-I1)                    HP  275
      GO TO (28,29,30),ICD                                               HP  276
   28 IF (A.GT.0.0D0) GO TO 29                                           HP  277
      CL=CFM(12)*A+YCPT+CFM(14)*TDAPX                                    HP  278
      GO TO 31                                                           HP  279
   29 CL=CFM(11)*CFM(12)*A+CFM(13)*A**EXPX+CFM(14)*TDAPX                 HP  280
      GO TO 31                                                           HP  281
   30 CL=CFM(11)*CFM(12)*A+CFM(13)*A*A+CFM(14)*TDAPX                     HP  282
   31 AF=A                                                               HP  283
C***  WRITE OUT RESULTS                                                  HP  284
      IF (KPRINT.NE.0) GO TO 34                                          HP  285
      IF (METRIC.NE.0) GO TO 33                                          HP  286
      WRITE (JWRITE,32) T,H,V,GFPA,A,CL,CD,W,P,DV                        HP  287
   32 FORMAT (1X,10(1PD12.5,1X))                                         HP  288
      GO TO 34                                                           HP  289
   33 ALT=H*0.3048D0                                                     HP  290
      VX=V*0.3048D0                                                      HP  291
      WX=W*4.448200                                                      HP  292
      PX=P*1.355818D-3                                                   HP  293
      DVH=DV*0.3048DC                                                    HP  294
      WRITE (JWRITE,32) T,ALT,VX,GFPA,A,CL,CD,WX,PX,DVH                  HP  295
C***  CALCULATE TIME INCREMENT                                           HP  296
   34 IF (I.LT.K)TDEL=TH(I-I1+2)-TH(I-I1+1)                              HP  297
C***  SET FLIGHT PATH ANGLE                                              HP  298
      GMX=GFPA                                                           HP  299
      IF (I.NE.1) GO TO 35                                               HP  300
C***  SET FLIGHT-PATH-ANGLE DERIVATIVE FOR FIRST POINT                   HP  301
      DGFPA=G*S*R*V*CL/(2.0D0*W)-G*DCOS(GMX)/V+G*DSIN(A+TIA)*P/(W*V*V)   HP  302
      D2G=0.0D0                                                          HP  303
      D3G=0.0D0                                                          HP  304
C***  SET OR DETERMINE PARAMETERS FOR TRAJECTORY PREDICTION              HP  305
   35 IF (I.NE.1)DGMX=DGMX                                               HP  306
      DGMX=DGFPA                                                         HP  307
      D2GM=D2G                                                           HP  308
      D3GM=D3G                                                           HP  309
      ADT=0.0D0                                                          HP  310
      IF (I.NE.1)ADT=(AF-AS)/TMT1                                        HP  311
      IPBM=0                                                             HP  312
      KK=0                                                               HP  313
      HGAM=GFPA                                                          HP  314
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      HDGSH=DGFPA                                                       HP  315
      JL=0                                                              HP  316
      IK=10                                                             HP  317
      ST1=T1                                                            HP  318
      IJPL=0                                                            HP  319
      IF (I.LT.7) IK=0                                                  HP  320
C***  CALL TRAJECTORY PREDICTION ROUTINE                                HP  321
      IF (I.LT.K) CALL TRENOR(TDEL,T,GFPA,DGFPA,D2G,D3G,ISET,F,IPRR,KK,I HP  322
     1K)                                                                HP  323
      IERR=IERR                                                         HP  324
      IF (IERR.NE.0) RETURN                                             HP  325
      T=TH(I-I1+1)                                                      HP  326
      T1=ST1                                                            HP  327
      IF (I.EQ.6) IK=10                                                 HP  328
      IF (I.LT.6) GO TO 37                                              HP  329
C***  ITERATE TRAJECTORY PREDICTION FOR BETTER ESTIMATION               HP  330
      DO 36 JPL=1,IK                                                    HP  331
      IPRR=IPRR+1                                                       HP  332
      IJPL=JPL                                                          HP  333
      GFPA=HGAM                                                         HP  334
      IF (I.LT.K) CALL TRENOR(TDEL,T,GFPA,DGFPA,D2G,D3G,ISET,F,IPRR,KK,I HP  335
     1K)                                                                HP  336
      IERR=IERR                                                         HP  337
      IF (IERR.NE.0) RETURN                                             HP  338
      T=TH(I-I1+1)                                                      HP  339
      T1=ST1                                                            HP  340
      IF (KK.EQ.1) GO TO 37                                             HP  341
   36 CONTINUE                                                          HP  342
   37 KPRINT=KPRINT+1                                                   HP  343
C***  TEST FOR INTERVAL RANGE END                                       HP  344
      IF (IPTS.NE.0.AND.KPRINT.EQ.IPTSP1) KPRINT=0                      HP  345
C***  DEFINE VALUES FOR PARTIAL DERIVATIVE EVALUATIONS                  HP  346
      T=TH(I-I1+1)                                                      HP  347
      IF (I.GE.7) GO TO 38                                              HP  348
      D2GH=0.0D0                                                        HP  349
      IF (I.NE.1) D2GH=(DGHX-DGHY)/(T-T1)                               HP  350
      D2G=D2GH                                                          HP  351
   38 ATX=A                                                             HP  352
      WTX=W                                                             HP  353
      RTX=R                                                             HP  354
      IF (I.NE.1) GO TO 41                                              HP  355
C***  INITIALIZE MATRICES                                               HP  356
      DO 39 JXP=1,NXD                                                   HP  357
      RR(JXP)=0.0D0                                                     HP  358
      RP(JXP)=0.0D0                                                     HP  359
      RQ(JXP)=0.0D0                                                     HP  360
   39 RS(JXP)=0.0D0                                                     HP  361
      DO 40 JXP=1,NUM                                                   HP  362
   40 CC(JXP)=0.0D0                                                     HP  363
C***  TEST FOR FIRST POINT DIRECTION                                    HP  364
   41 IF (I.EQ.1) GO TO 71                                              HP  365
C***  TEST FOR PARTIAL DERIVATIVE DETERMINATION                         HP  366
      IF (KPRINT.NE.1) GO TO 87                                         HP  367
C***  DEFINE SCALAR VALUES AT PRESENT AND PREVIOUS POINTS               HP  368
      J=J+1                                                             HP  369
      T1=TTPT                                                           HP  370
      IF (I.EQ.K) T1=TH(1)                                              HP  371
      VP=VA(T)                                                          HP  372
      V=VA(T1)                                                          HP  373
      DV=DVA(T1)                                                        HP  374
      P=CFN(1)+CFN(2)*V**EX1+CFN(3)*V**EX2+CFN(4)*V**EX3+CFN(5)*V**EX4  HP  375
      A=AT                                                              HP  376
      AM=DABS(A)                                                        HP  377
      TDAPX=((I-I1)*P3(IPT)+(I1-I)*P3(IPT-1))/(I1-I1)                   HP  378
      GO TO (42,43,44),ICD                                              HP  379
   42 IF (A.GT.0.0D0) GO TO 43                                          HP  380
      CL=CFN(12)*A+YCPT+CFN(14)*TDAPX                                   HP  381
      GO TO 45                                                          HP  382
   43 CL=CFN(11)+CFN(12)*A+CFN(13)*A**EXPX+CFN(14)*TDAPX                HP  383
      GO TO 45                                                          HP  384
   44 CL=CFN(11)+CFN(12)*A+CFN(13)*A*A+CFN(14)*TDAPX                    HP  385
   45 IF (A.LT.0.0D0) CALL SIGNS(SNM,IEX1,IEX2,IEX3,IEX4)               HP  386
      CD=CFN(6)+SNM(1)*CFN(7)*AM**IEX1+SNM(2)*CFN(8)*AM**IEX2+SNM(3)*CFN HP  387
     1(9)*AM**IEX3+SNM(4)*CFN(10)*AM**IEX4                              HP  388
      IF (A.LT.0.0D0) CALL CHNGE(SNM)                                   HP  389
      W=WT                                                              HP  390
      R=RT                                                              HP  391
      HDH=V*DSIN(FPA)                                                   HP  392
C***  FIND PARTIAL DERIVATIVES WRT ANGLE OF ATTACK                      HP  393
      CALL PARTAL(J,W,R,A,V,DV,HDH,FPA,DFPA,PAC,HCH)                    HP  394
C***  COMPUTE NECESSARY FACTORS AND TERMS FOR DERIVATIVE EVALUATIONS    HP  395
      TBT1=T-T1                                                         HP  396
      X1=V**EX1                                                         HP  397
      X2=V**EX2                                                         HP  398
      X3=V**EX3                                                         HP  399
      X4=V**EX4                                                         HP  400
      X5=A**IEX1                                                        HP  401
      X6=A**IEX2                                                        HP  402
      X7=A**IEX3                                                        HP  403
      X8=A**IEX4                                                        HP  404
      X9=DCOS(A+TIA)/(W*V)                                              HP  405
      X10=R*S*V*V/(2.0D0*W)                                             HP  406
      X11=DV/G                                                          HP  407
      X12=X9*P-(X10*CD+X11)                                             HP  408
      X13=DSQRT(1.0D0-X12*X12)                                          HP  409
      X14=G*TBT1**2*X10/2.0D0                                           HP  410
      X15=TBT1*DCOS(A+TIA)/W                                            HP  411
      X16=TBT1**2*DV*X9/2.0D0                                           HP  412
      X17=TBT1**2*G*DSIN(A+TIA)/(2.0*W*V)                               HP  413
      X18=TBT1**2*G/4.0D0                                               HP  414
      X19=-TBT1*V*X10                                                   HP  415
      X20=-TBT1**2*DV*X10/2.0D0                                         HP  416
      X21=G*DSIN(A+TIA)/(W*V*V)                                         HP  417
      X22=DV*DDV(T1)*TBT1/3.0D0                                         HP  418
      X23=DV*DV*TBT1/3.0D0                                              HP  419
      X24=-X13*X14                                                      HP  420
      X25=G*S*R*V/(2.0D0*W)                                             HP  421
      X26=X9*X9*X12/X13**3                                              HP  422
      X27=X10*X10*X12/X13**3                                            HP  423
      X28=X9*X10*X12/X13**3                                             HP  424
      X29=-X14*X12/X13                                                  HP  425
C***  INITIALIZE PARAMETERS                                             HP  426
      DO 46 JXP=1,10                                                    HP  427
   46 PS(JXP)=0.0D0                                                     HP  428
      JJX=0                                                             HP  429
C***  COMPUTE PARTIAL DERIVATIVES                                       HP  430
      CTP(1)=-(X15+X16+(X13*X17+4.0D0*X18*X12*X9)-(X17*P)/X13*X12*X9)   HP  431
      CTP(2)=X9/X13                                                     HP  432
      CTP(3)=X21+G/V*X12*X9/X13                                         HP  433
      CTP(4)=-(X19+X20-4.0D0*X18*X12*X10-2.0D0*X18*X10**2*CL*X12/X13+X17 HP  434
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     1*X12*X10*P/X13)                                                    HP  435
      CTP(5)=-X10/X13                                                    HP  436
      CTP(6)=-G/V*X12*X10/X13                                            HP  437
      CTP(7)=0.0D0                                                       HP  438
      DO 70 JPK=1,NEQ                                                    HP  439
      IF (CFM(JPK).EQ.0.0D0.OR.JLOC(JPK).NE.0) GO TO 70                  HP  440
      JJX=JJX+1                                                          HP  441
      WK(2,JJX)=0.0D0                                                    HP  442
      WK(4,JJX)=0.0D0                                                    HP  443
      WK(6,JJX)=0.0D0                                                    HP  444
      GO TO (47,49,51,53,55,57,59,61,63,65,67,68,69),JPK                 HP  445
C***  COMPUTE PARTIALS WRT FIRST POWER COEFFICIENT                       HP  446
   47 DO 48 JXP=1,3                                                      HP  447
   48 WK(JXP,JJX)=CTP(JXP)                                               HP  448
      WK(4,JJX)=P*THT1                                                   HP  449
      WK(5,JJX)=WK(5,JJX)+0.5D0*THT1*(DCOS(ATX+TIA)/WTX+DCOS(A+TIA)/W)   HP  450
      PS(1)=CFM(1)*WK(5,JJX)                                             HP  451
      GO TO 70                                                           HP  452
C***  COMPUTE PARTIALS WRT SECOND POWER COEFFICIENT                      HP  453
   49 DO 50 JL=1,3                                                       HP  454
   50 WK(JL,JJX)=CTP(JL)*X1                                              HP  455
      WK(4,JJX)=P*(V**EX1*THT1+THT1**2/2.0D0*EX1*(X22*V**(EX1-1.0D0)+(EX HP  456
     11-1.0D0)*X23*V**(EX1-2.0D0)))                                      HP  457
      WK(5,JJX)=WK(5,JJX)+0.5D0*THT1*(DCOS(ATX+TIA)*VP**EX1/WTX+DCOS(A+T HP  458
     1IA)*V**EX1/W)                                                      HP  459
      PS(2)=CFM(2)*WK(5,JJX)                                             HP  460
      GO TO 70                                                           HP  461
C***  COMPUTE PARTIALS WRT THIRD POWER COEFFICIENT                       HP  462
   51 DO 52 JL=1,3                                                       HP  463
   52 WK(JL,JJX)=CTP(JL)*X2                                              HP  464
      WK(4,JJX)=P*(V**EX2*THT1+THT1**2/2.0D0*EX2*(X22*V**(EX2-1.0D0)+(EX HP  465
     12-1.0D0)*X23*V**(EX2-2.0D0)))                                      HP  466
      WK(5,JJX)=WK(5,JJX)+0.5D0*THT1*(DCOS(ATX+TIA)*VP**EX2/WTX+DCOS(A+T HP  467
     1IA)*V**EX2/W)                                                      HP  468
      PS(3)=CFM(3)*WK(5,JJX)                                             HP  469
      GO TO 70                                                           HP  470
C***  COMPUTE PARTIALS WRT FOURTH POWER COEFFICIENT                      HP  471
   53 DO 54 JL=1,3                                                       HP  472
   54 WK(JL,JJX)=CTP(JL)*X3                                              HP  473
      WK(4,JJX)=P*(V**EX3*THT1+THT1**2/2.0D0*EX3*(X22*V**(EX3-1.0D0)+(EX HP  474
     13-1.0D0)*X23*V**(EX3-2.0D0)))                                      HP  475
      WK(5,JJX)=WK(5,JJX)+0.5D0*THT1*(DCOS(ATX+TIA)*VP**EX3/WTX+DCOS(A+T HP  476
     1IA)*V**EX3/W)                                                      HP  477
      PS(4)=CFM(4)*WK(5,JJX)                                             HP  478
      GO TO 70                                                           HP  479
C***  COMPUTE PARTIALS WRT FIFTH POWER COEFFICIENT                       HP  480
   55 DO 56 JL=1,3                                                       HP  481
   56 WK(JL,JJX)=CTP(JL)*X4                                              HP  482
      WK(4,JJX)=P*(V**EX4*THT1+THT1**2/2.0D0*EX4*(X22*V**(EX4-1.0D0)+(EX HP  483
     14-1.0D0)*X23*V**(EX4-2.0D0)))                                      HP  484
      WK(5,JJX)=WK(5,JJX)+0.5D0*THT1*(DCOS(ATX+TIA)*VP**EX4/WTX+DCOS(A+T HP  485
     1IA)*V**EX4/W)                                                      HP  486
      PS(5)=CFM(5)*WK(5,JJX)                                             HP  487
      GO TO 70                                                           HP  488
C***  COMPUTE PARTIALS WRT FIRST DRAG COEFFICIENT                        HP  489
   57 DO 58 JXP=1,4                                                      HP  490
   58 WK(JXP,JJX)=CTP(JXP+3)                                             HP  491
      WK(5,JJX)=WK(5,JJX)-0.25D0*THT1*S*(RTX*VP**3/WTX+R*V**3/W)         HP  492
      PS(6)=CFM(6)*WK(5,JJX)                                             HP  493
      WK(6,JJX)=PAC(1)                                                   HP  494
      GO TO 70                                                           HP  495
C***  COMPUTE PARTIALS WRT SECOND DRAG COEFFICIENT                       HP  496
   59 DO 60 JL=1,4                                                       HP  497
   60 WK(JL,JJX)=CTP(JL+3)*X5                                            HP  498
      WK(5,JJX)=WK(5,JJX)-0.25D0*THT1*S*(RTX*VP**3*ATX**IEX1/WTX+R*V**3* HP  499
     1A**IEX1/W)                                                         HP  500
      PS(7)=CFM(7)*WK(5,JJX)                                             HP  501
      WK(6,JJX)=PAC(2)                                                   HP  502
      GO TO 70                                                           HP  503
C***  COMPUTE PARTIALS WRT THIRD DRAG COEFFICIENT                        HP  504
   61 DO 62 JL=1,4                                                       HP  505
   62 WK(JL,JJX)=CTP(JL+3)*X6                                            HP  506
      WK(5,JJX)=WK(5,JJX)-0.25D0*THT1*S*(RTX*VP**3*ATX**IEX2/WTX+R*V**3* HP  507
     1A**IEX2/W)                                                         HP  508
      PS(8)=CFM(8)*WK(5,JJX)                                             HP  509
      WK(6,JJX)=PAC(3)                                                   HP  510
      GO TO 70                                                           HP  511
C***  COMPUTE PARTIALS WRT FOURTH DRAG COEFFICIENT                       HP  512
   63 DO 64 JL=1,4                                                       HP  513
   64 WK(JL,JJX)=CTP(JL+3)*X7                                            HP  514
      WK(5,JJX)=WK(5,JJX)-0.25D0*THT1*S*(RTX*VP**3*ATX**IEX3/WTX+R*V**3* HP  515
     1A**IEX3/W)                                                         HP  516
      PS(9)=CFM(9)*WK(5,JJX)                                             HP  517
      WK(6,JJX)=PAC(4)                                                   HP  518
      GO TO 70                                                           HP  519
C***  COMPUTE PARTIALS WRT FIFTH DRAG COEFFICIENT                        HP  520
   65 DO 66 JL=1,4                                                       HP  521
   66 WK(JL,JJX)=CTP(JL+3)*X8                                            HP  522
      WK(5,JJX)=WK(5,JJX)-0.25D0*THT1*S*(RTX*VP**3*ATX**IEX4/WTX+R*V**3* HP  523
     1A**IEX4/W)                                                         HP  524
      PS(10)=CFM(10)*WK(5,JJX)                                           HP  525
      WK(6,JJX)=PAC(5)                                                   HP  526
      GO TO 70                                                           HP  527
C***  COMPUTE PARTIALS WRT FIRST LIFT COEFFICIENT                        HP  528
   67 WK(1,JJX)=X24                                                      HP  529
      WK(3,JJX)=X25                                                      HP  530
      WK(6,JJX)=PAC(6)                                                   HP  531
      GO TO 70                                                           HP  532
C***  COMPUTE PARTIALS WRT SECOND LIFT COEFFICIENT                       HP  533
   68 WK(1,JJX)=X24*A                                                    HP  534
      WK(3,JJX)=X25*A                                                    HP  535
      WK(6,JJX)=PAC(7)                                                   HP  536
      GO TO 70                                                           HP  537
C***  COMPUTE PARTIALS WRT THIRD LIFT COEFFICIENT                        HP  538
   69 WK(1,JJX)=X24*A**EXPX                                              HP  539
      WK(3,JJX)=X25*A**EXPX                                              HP  540
      WK(6,JJX)=PAC(8)                                                   HP  541
   70 CONTINUE                                                           HP  542
C***  COMPUTE DIFFERENCES FOR ALL POINTS                                 HP  543
   71 CK(1)=H-F10(J+1)                                                   HP  544
      IF (DABS(CK(1)).LE.4.0D-06)CK(1)=0.0D0                             HP  545
      CK(2)=HGAM-DARSIN(F11(J+1)/FN(J+1))                                HP  546
      IF (DABS(HGAM).LT.6.0D-03)ICKP=1                                   HP  547
      IF (DABS(CK(2)).LE.1.0D-08)CK(2)=0.0D0                             HP  548
      CK(3)=HDGMR-FT2(J+1)                                               HP  549
      IF (DABS(CK(3)).LT.3.0D-07)CK(3)=0.0D0                             HP  550
      IF ((J+1).EQ.1) GO TO 77                                           HP  551
C***  ZERO OUT SECOND-PARTIAL-DERIVATIVE ARRAYS                          HP  552
      DO 72 JPK=1,NEQ                                                    HP  553
      DO 72 JL=1,NEQ                                                     HP  554
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      ZH(JL,JPK)=0.0D0                                                  HP  555
      ZL(JL,JPK)=0.0D0                                                  HP  556
   72 ZK(JL,JPK)=0.0D0                                                  HP  557
C***  STORE FACTORS FOR 2ND PARTIAL DERIVATIVES                         HP  558
      FS(1)=1.0D0                                                       HP  559
      FS(2)=X1                                                          HP  560
      FS(3)=X2                                                          HP  561
      FS(4)=X3                                                          HP  562
      FS(5)=X4                                                          HP  563
      FS(6)=1.0D0                                                       HP  564
      FS(7)=X5                                                          HP  565
      FS(8)=X6                                                          HP  566
      FS(9)=X7                                                          HP  567
      FS(10)=X8                                                         HP  568
      FS(11)=1.0D0                                                      HP  569
      FS(12)=A                                                          HP  570
      FS(13)=A**EXPX                                                    HP  571
C***  COMPUTE SECOND PARTIALS OF FLIGHT PATH ANGLE, ITS RATE, AND       HP  572
C***  ALTITUDE                                                          HP  573
      ZAP1=-CK(2)*X26                                                   HP  574
      ZAP2=CK(2)*X28                                                    HP  575
      ZAP3=-CK(3)*G*X9*X9/(V*X13)*(1.0D0+(X12/X13)**2)                  HP  576
      ZAP4=CK(3)*G*X9*X10/(V*X13)*(1.0D0+(X12/X13)**2)                  HP  577
      ZAP5=-CK(1)*(-X12*X9/X13*(2.0D0*X17*G*THT1**2*X12*X9/X13)*2.0D0*X1 HP  578
     18*X9*X9/X13**2-(X14*CL*X17*P-2.0D0*X18*X13)*((X9*X12)**2/X13**3*X9 HP  579
     1*X9/X13))                                                         HP  580
      ZAP6=-CK(1)*(X12/X13*X10*(X17*2.0D0*X18*X12*X9/X13)-2.0D0*X18*X10* HP  581
     1X9*(X14*CL*X17*P-2.0D0*X18*X13)*(X9*X10*X12**2/X13**3*X9*X10/X13)) HP  582
      DO 73 JL=1,5                                                      HP  583
      DO 73 JH=1,5                                                      HP  584
      ZK(JH,JL)=ZAP1*FS(JH)*FS(JL)                                      HP  585
      ZK(JH+5,JL)=ZAP2*FS(JH+5)*FS(JL)                                  HP  586
      ZL(JH,JL)=ZAP3*FS(JH)*FS(JL)                                      HP  587
      ZL(JH+5,JL)=ZAP4*FS(JH+5)*FS(JL)                                  HP  588
      ZH(JH,JL)=ZAP5*FS(JH)*FS(JL)                                      HP  589
   73 ZH(JH+5,JL)=ZAP6*FS(JH+5)*FS(JL)                                  HP  590
      ZAP1=CK(2)*X28                                                    HP  591
      ZAP2=-CK(2)*X27                                                   HP  592
      ZAP3=CK(3)*G*X9*X10/(V*X13)*(1.0D0+(X12/X13)**2)                  HP  593
      ZAP4=-CK(3)*G*X10*X10/(V*X13)*(1.0D0+(X12/X13)**2)                HP  594
      ZAP5=-CK(1)*(X12/X13*X10*(X17*2.0D0*X18*X12*X9/X13)-2.0D0*X18*X10* HP  595
     1X9+(X14*CL*X17*P-2.0D0*X18*X13)*(X9*X10*X12**2/X13**3*X9*X10/X13)) HP  596
      ZAP6=-CK(1)*(X10**2*(2.0D0*X18*(1.0D0-X12**2/X13**2)-(X14*CL*X17*P HP  597
     1-2.0D0*X18*X13)*(X12**2/X13**3+1.0D0/X13)))                       HP  598
      DO 74 JL=6,10                                                     HP  599
      DO 74 JH=1,5                                                      HP  600
      ZK(JH,JL)=ZAP1*FS(JH)*FS(JL)                                      HP  601
      ZK(JH+5,JL)=ZAP2*FS(JH+5)*FS(JL)                                  HP  602
      ZL(JH,JL)=ZAP3*FS(JH)*FS(JL)                                      HP  603
      ZL(JH+5,JL)=ZAP4*FS(JH+5)*FS(JL)                                  HP  604
      ZH(JH,JL)=ZAP5*FS(JH)*FS(JL)                                      HP  605
   74 ZH(JH+5,JL)=ZAP6*FS(JH+5)*FS(JL)                                  HP  606
      ZAP7=-CK(1)*X29*X9                                                HP  607
      ZAP8=CK(1)*X29*X10                                                HP  608
C***  STORE PARTIALS OF LIFT COEFFICIENTS                               HP  609
      DO 75 JH=11,13                                                    HP  610
      DO 75 JL=1,5                                                      HP  611
      ZH(JH,JL)=ZAP7*FS(JL)*FS(JH)                                      HP  612
      ZH(JH,JL+5)=ZAP8*FS(JL+5)*FS(JH)                                  HP  613
      ZH(JL,JH)=ZH(JH,JL)                                               HP  614
   75 ZH(JL+5,JH)=ZH(JH,JL+5)                                           HP  615
C***  COMPUTE MATRIX OF 2ND PARTIALS OF J MRT MODEL COEFFICIENTS        HP  616
      JJ=0                                                              HP  617
      JJJ=0                                                             HP  618
      DO 76 JPX=1,NEQ                                                   HP  619
      IF (CFM(JPX).EQ.0.0D0.OR.JLOC(JPX).NE.0) GO TO 76                 HP  620
      JJ=JJ+1                                                           HP  621
      DO 76 JPY=1,NEQ                                                   HP  622
      IF (CFM(JPY).EQ.0.0D0.OR.JLOC(JPY).NE.0) GO TO 76                 HP  623
      JJJ=JJJ+1                                                         HP  624
      THK(JJJ)=ZK(JPX,JPY)*D(2)                                         HP  625
      TWKK(JJJ)=ZL(JPX,JPY)*D(3)                                        HP  626
      TWKX(JJJ)=ZH(JPX,JPY)*D(1)                                        HP  627
   76 CONTINUE                                                          HP  628
C***  SUM MATRICES OF SECOND PARTIALS                                   HP  629
      CALL MADD(RP,TWK,RP,JJ,JJ,0,0)                                   HP  630
      CALL MADD(RQ,TWKK,RQ,JJ,JJ,0,0)                                  HP  631
      CALL MADD(RS,TWKX,RS,JJ,JJ,0,0)                                  HP  632
   77 CK(4)=MTX-MM(J+1)                                                 HP  633
      IF (DABS(CK(4)).GT.1.0D-04) GO TO 78                              HP  634
      MTX=MM(J+1)                                                       HP  635
      CK(4)=0.0D0                                                       HP  636
   78 EMER(1)=EMER(2)                                                   HP  637
      EMER(2)=EMER(3)                                                   HP  638
      P=CFM(1)*CFM(2)*F4(J+1)**EX1+CFM(3)*F4(J+1)**EX2+CFM(4)*F4(J+1)**E HP  639
     1X3+CFM(5)*F4(J+1)**EX4                                            HP  640
      IF (ATX.LT.0.0D0) CALL SIGNS(SNM,IEX1,IEX2,IEX3,IEX4)             HP  641
      AM=DABS(ATX)                                                      HP  642
      CD=CFM(6)+CFM(7)*SNM(1)*AM**IEX1+CFM(8)*SNM(2)*AM**IEX2+CFM(9)*SNM HP  643
     1(3)*AM**IEX3+CFM(10)*SNM(4)*AM**IEX4                              HP  644
      IF (ATX.LT.0.0D0) CALL CHNGE(SNM)                                 HP  645
      EMER(3)=P*DCOS(ATX+TIA)/MTX-ATX*S*F4(J+1)**3/(2.0D0*MTX)*CD       HP  646
      IF ((J+1).EQ.1)ENERGY=F4(1)**2/(2.0D0*G)+F10(1)                   HP  647
      IF ((J+1).GT.2) GO TO 79                                          HP  648
      IF ((J+1).EQ.1) GO TO 80                                          HP  649
      ENERGY=ENERGY+PS(1)*PS(2)*PS(3)*PS(4)*PS(5)*PS(6)*PS(7)*PS(8)*PS(9 HP  650
     1)*PS(10)                                                          HP  651
      GO TO 80                                                          HP  652
   79 TA1=TIME(IPT-3)-TIME(IPT-2)                                       HP  653
      TA2=0.0D0                                                         HP  654
      TA3=TIME(IPT-1)-TIME(IPT-2)                                       HP  655
      C1=((EMER(1)-EMER(2))/(TA1-TA2)-(EMER(2)-EMER(3))/(TA2-TA3))/(TA1- HP  656
     1TA3)                                                              HP  657
      C2=(EMER(1)-EMER(2))/(TA1-TA2)-C1*(TA1+TA2)                       HP  658
      C3=EMER(1)-TA1*(C1*TA1+C2)                                        HP  659
      ENERGY=ENERGY+C1/3.0D0*(TA3**3-TA2**3)+C2/2.0D0*(TA3**2-TA2**2)+C3 HP  660
     1*(TA3-TA2)                                                        HP  661
   80 CK(5)=ENERGY-F4(J+1)**2/(2.0D0*G)-F10(J+1)                        HP  662
      IF ((J+1).EQ.2)ENERGY=ENERGY-CK(5)                                HP  663
      IF ((J+1).EQ.2)CK(5)=0.0D0                                        HP  664
      IF (DABS(CK(5)).LT.3.0D-05)CK(5)=0.0D0                            HP  665
      CK(6)=ATX-F6(J+1)                                                 HP  666
      IF (DABS(CK(6)).LT.1.0D-03)CK(6)=0.0D0                            HP  667
      IF ((J+1).EQ.1) GO TO 83                                          HP  668
C***  SUM MATRICES OF PARTIALS                                          HP  669
      IP=0                                                              HP  670
      JJ=0                                                              HP  671
      DO 82 JXP=1,NEQ                                                   HP  672
      IF (CFM(JXP).EQ.0.0D0.OR.JLOC(JXP).NE.0) GO TO 82                 HP  673
      IP=IP+1                                                           HP  674
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      STWJ=0.0D0                                                        MP  675
      DO 81 JP=1,6                                                      MP  676
      JJ=JJ+1                                                           MP  677
      TWK(JJ)=WK(JP,IP)*DSQRT(D(JP))                                    MP  678
   81 STWJ=STWJ+TWK(JJ)*CK(JP)*DSQRT(D(JP))                             MP  679
      TWJ(IP)=STWJ                                                      MP  680
   82 CONTINUE                                                          MP  681
      MS=0                                                              MP  682
      CALL DATA(TWK,TWKK,6,IP,MS)                                       MP  683
      CALL MADD(RR,TWKK,RR,IP,IP,0,1)                                   MP  684
      CALL MADD(CC,TWJ,CC,IP,1,0,0)                                     MP  685
C***  COMPUTE SUM OF SQUARED RESIDUALS                                  MP  686
   83 DO 84 JXP=1,6                                                     MP  687
   84 TOL(JXP)=TOL(JXP)+CK(JXP)*CK(JXP)                                 MP  688
C***  STORE AND DEFINE PARAMETERS                                       MP  689
      A=ATX                                                             MP  690
      W=WTX                                                             MP  691
      B=BTX                                                             MP  692
      IF (LKK.EQ.1) GO TO 86                                            MP  693
      DO 85 JXP=1,3                                                     MP  694
   85 XHLD(JXP,J+1)=HLD(JXP,J+1)                                        MP  695
   86 HLD(1,J+1)=F1(J+1)                                                MP  696
      HLD(2,J+1)=F5(J+1)                                                MP  697
      HLD(3,J+1)=F6(J+1)                                                MP  698
      F1(J+1)=W                                                         MP  699
      F5(J+1)=B                                                         MP  700
      F6(J+1)=A                                                         MP  701
   87 IF (IPTS.EQ.0.AND.KPRINT.EQ.IPTSP1)KPRINT=0                       MP  702
C***  PROCEED WITH NEXT POINT                                           MP  703
   88 CONTINUE                                                          MP  704
      IF (LCH.NE.0) WRITE (JWRITE,89) LCH                               MP  705
   89 FORMAT (1X,///,9X,94H*** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK MP  706
     1IH  HPATH, ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)     MP  707
      IF (HCH.NE.0) WRITE (JWRITE,90) HCH                               MP  708
   90 FORMAT (1X,///,9X,94H*** DURING NEWTON-RAPHSON FOR ANGLE OF ATTACK MP  709
     1IH PARTAL, ROUTINE WISHED TO SEEK COMPLEX ROOTS ,I3,7H TIMES.)     MP  710
C***  DETERMINE APPROPRIATE A PRIORI VALUE APPLICATION                  MP  711
      IJX=0                                                             MP  712
      DO 91 JXP=1,NEQ                                                   MP  713
      SF(JXP)=1.0D0                                                     MP  714
      IF (CFH(JXP).EQ.0.0D0.OR.JLOC(JXP).NE.0) GO TO 91                 MP  715
      IJX=IJX+1                                                         MP  716
      ILOC(IJX)=JXP                                                     MP  717
      DSL(IJX)=SCALE(JXP)                                               MP  718
   91 CONTINUE                                                          MP  719
C***  COMPUTE THE  COST FUNCTION                                        MP  720
      PCF=0.0D0                                                         MP  721
      PPCF=0.0D0                                                        MP  722
      DO 92 JXP=1,IP                                                    MP  723
C***  SET A PRIORI VALUE AS MODEL COEFFICIENT IF CONDITION IS MET       MP  724
      IF (JLOC(ILOC(JXP)).NE.0) AP(ILOC(JXP))=CFH(ILOC(JXP))            MP  725
   92 PPCF=PPCF+WGT(ILOC(JXP))*(CFH(ILOC(JXP))-AP(ILOC(JXP)))**2/(AP(ILO MP  726
     1C(JXP))*AP(ILOC(JXP)))                                            MP  727
      DO 93 JXP=1,6                                                     MP  728
   93 PCF=PCF+D(JXP)*TOL(JXP)                                           MP  729
      IF (IPS.NE.0)JK=1                                                 MP  730
      COST(JK)=PCF+PPCF                                                 MP  731
      WRITE (JWRITE,94) COST(JK)                                        MP  732
   94 FORMAT (1X,///,33X,'COST FUNCTION (J) = ',1PD23.16,/,33X,'WITH:')  MP  733
      DO 95 JXP=1,6                                                     MP  734
   95 TOL(JXP)=TOL(JXP)/N                                               MP  735
      WRITE (JWRITE,96) (TOL(JXP),JXP=1,6)                              MP  736
   96 FORMAT (39X,'ALTITUDE TOLERANCE = ',D20.13,/,39X,'FLIGHT-PATH-ANGL MP  737
     1E TOLERANCE = ',D20.13,/,39X,'FLIGHT-PATH-ANGLE-DERIVATIVE TOLERAN MP  738
     1CE = ',D20.13,/,39X,'WEIGHT TOLERANCE = ',D20.13,/,39X,'ENERGY TOL MP  739
     1ERANCE = ',D20.13,/,39X,'ANGLE-OF-ATTACK TOLERANCE = ',D20.13,///)  MP  740
C***  UPDATE COST FUNCTION                                              MP  741
C***  CHECK COST FUNCTION WITH TOLERANCE FOR ITERATION TERMINATION      MP  742
      IF (COST(JK).LT.1.0D-10) GO TO 133                                MP  743
      IF (JK.EQ.1)HCOST=COST(1)                                         MP  744
C***  TEST FOR INCREASE IN COST FUNCTION                                MP  745
      IF (JK.GT.1.AND.COST(JK).GT.HCOST) GO TO 130                      MP  746
      HCOST=COST(JK)                                                    MP  747
C***  ADJUST MATRICES FOR LEAST SQUARES SOLUTION                        MP  748
      CALL MADD(RR,RP,RR,IP,IP,0,0)                                     MP  749
      CALL MADD(RR,RQ,RR,IP,IP,0,0)                                     MP  750
      CALL MADD(RR,RS,RX,IP,IP,0,0)                                     MP  751
      MIDD=IP*IP                                                        MP  752
      IPS=0                                                             MP  753
      IPSMX=0                                                           MP  754
      DO 97 JL=1,MIDD                                                   MP  755
   97 RIS(JL)=RX(JL)                                                    MP  756
      DO 98 JL=1,IP                                                     MP  757
   98 CCX(JL)=CC(JL)                                                    MP  758
   99 IC=0                                                              MP  759
      IPSMX=IPSMX+1                                                     MP  760
      IF (IPS.EQ.0) GO TO 101                                           MP  761
C***  APPLY CONSTRAINTS AND SIGN FACTOR, IF NEEDED                      MP  762
      JJ=0                                                              MP  763
      DO 100 JXP=1,NEQ                                                  MP  764
      IF (CFH(JXP).EQ.0.0D0.OR.JLOC(JXP).NE.0) GO TO 100                MP  765
      JJ=JJ+1                                                           MP  766
      IF ((CFH(JXP)+FIX*Y(JJ,1)*SCALE(JXP)).GE.CRMIN(JXP).AND.(CFH(JXP)+ MP  767
     1FIX*Y(JJ,1)*SCALE(JXP)).LE.CRMAX(JXP)) GO TO 100                  MP  768
      IF (IPSMX.GT.2.AND.RWT(JXP,1).NE.0.0D0)RWT(JXP,1)=RWT(JXP,1)*10.0D MP  769
     10                                                                 MP  770
      IF (IPSMX.GT.2.AND.RWT(JXP,2).NE.0.0D0)RWT(JXP,2)=RWT(JXP,2)*10.0D MP  771
     10                                                                 MP  772
      IF (IPSMX.GT.2.AND. (RWT(JXP,1).NE.0.0D0.OR.RWT(JXP,2).NE.0.0D0)) G MP  773
     10 TO 100                                                          MP  774
      IF ((CFH(JXP)+FIX*Y(JJ,1)*SCALE(JXP)).LT.CRMIN(JXP))RWT(JXP,1)=WGT MP  775
     1L(JXP)                                                            MP  776
      IF ((CFH(JXP)+FIX*Y(JJ,1)*SCALE(JXP)).GT.CRMAX(JXP))RWT(JXP,2)=WGT MP  777
     10(JXP)                                                            MP  778
      IF (CFH(JXP).GT.CRMIN(JXP).AND.RWT(JXP,1).NE.0.0D0)SF(JXP)=-0.5D0 MP  779
      IF (CFH(JXP).LT.CRMAX(JXP).AND.RWT(JXP,2).NE.0.0D0)SF(JXP)=-0.5D0 MP  780
      IF ((JXP.EQ.8.AND.(FIX*Y(JJ,1)*SCALE(JXP)).LT.0.0D0).AND.(CFH(JXP) MP  781
     1+FIX*Y(JJ,1)*SCALE(JXP)).LT.CRMIN(JXP))CRMIN(JXP)=CRMIN(JXP)-FIX*Y MP  782
     1(JJ,1)*SCALE(JXP)                                                 MP  783
  100 CONTINUE                                                          MP  784
C***  FORM MATRIX FOR LEAST-SQUARES SOLUTION                            MP  785
  101 DO 103 JXP1=1,IP                                                  MP  786
      IF (DABS(CFH(ILOC(JXP1))).LT.1.0D-03.AND.ILOC(JXP1).EQ.11)AP(ILOC( MP  787
     1JXP1))=1.0D-10                                                    MP  788
      IF (DABS(CFH(ILOC(JXP1))).LT.1.0D-03.AND.ILOC(JXP1).EQ.11)WGT(ILOC MP  789
     1(JXP1))=1.0D-17                                                   MP  790
      IF (LKK.GT.4.AND.(WGT(ILOC(JXP1)).GT.0.0D0.AND.ILOC(JXP1).EQ.11))W MP  791
     1GT(ILOC(JXP1))=2.5D0*WGT(ILOC(JXP1))                              MP  792
      DO 102 JXP2=1,IP                                                  MP  793
      KPAC=1.0D0                                                        MP  794
```

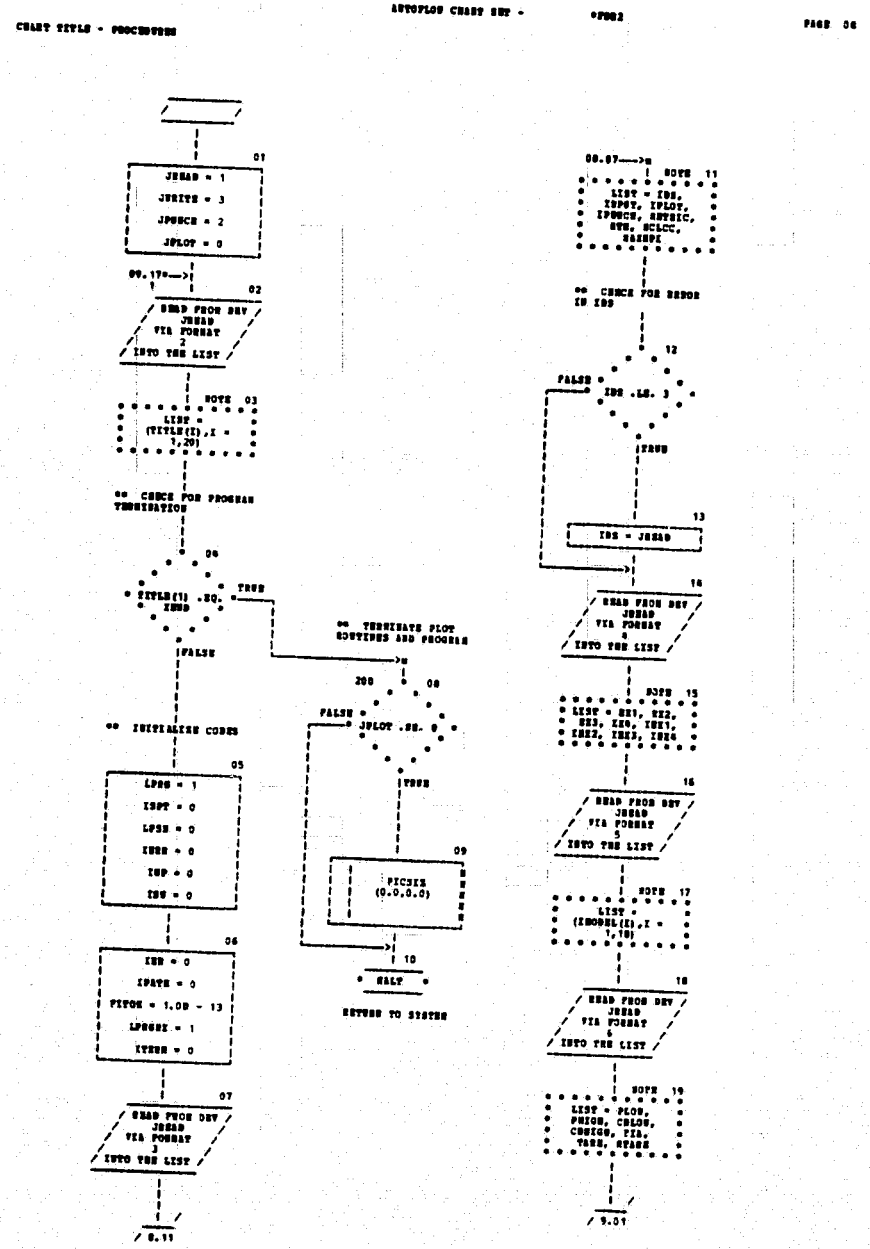
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      IF (JXP1.EQ.JXP2) XFAC=1.00005D0*DSL(JXP1)                        HP  795
      IC=IC+1                                                           HP  796
      IC=BX(IC)                                                         HP  797
      IF (JXP1.EQ.JXP2) IC=IC+2.0D0*WGT(ILOC(JXP1))/(AP(ILOC(JXP1))*AP(IL HP  798
     1OC(JXP1)))                                                        HP  799
      IF (JXP1.EQ.JXP2.AND.IPS.NE.0) IC=IC+2.0D0*RWT(ILOC(JXP1),1)+2.0D0* HP  800
     1RWT(ILOC(JXP1),2)                                                 HP  801
      U(JXP2,JXP1)=IC*XFAC                                              HP  802
  102 ZM(JXP2,JXP1)=U(JXP2,JXP1)                                        HP  803
      Y(JXP1,1)=-CC(JXP1)+2.0D0*WGT(ILOC(JXP1))*(AP(ILOC(JXP1))-CFM(ILOC HP  804
     1(JXP1)))/(AP(ILOC(JXP1))*AP(ILOC(JXP1)))                          HP  805
      IF (IPS.NE.0) Y(JXP1,1)=Y(JXP1,1)-2.0D0*SF(ILOC(JXP1))*RWT(ILOC(JXP HP  806
     11),1)*(CFM(ILOC(JXP1))-CRMIN(ILOC(JXP1)))+2.0D0*SF(ILOC(JXP1))*RWT HP  807
     1(ILOC(JXP1),2)*(CRMAX(ILOC(JXP1))-CFM(ILOC(JXP1)))                HP  808
  103 YS(JXP1,1)=Y(JXP1,1)                                              HP  809
C***  EXACT LEAST SQUARES SOLUTION                                      HP  810
      CALL LLSQAR(U,Y,IP,IP,1,13,13,15,WKAR,IER,JWRITE)                 HP  811
C***  TEST FOR ERROR                                                    HP  812
      IF (IER.EQ.129) IERR=1                                            HP  813
      IF (IERR.NE.0) RETURN                                             HP  814
      IF (IPSHX.GE.3) GO TO 107                                         HP  815
C***  TEST FOR APPLICATION OF CONSTRAINTS                               HP  816
      IFIX=0                                                            HP  817
      JJ=0                                                              HP  818
      DO 104 JXP=1,NEQ                                                  HP  819
      IF (CFM(JXP).EQ.0.0D0.OR.JLOC(JXP).NE.0) GO TO 104                HP  820
      JJ=JJ+1                                                           HP  821
      IF ((CFM(JXP)+FIX*Y(JJ,1)*SCALE(JXP)).LT.CRMIN(JXP).OR.(CFM(JXP)+F HP  822
     1IX*Y(JJ,1)*SCALE(JXP)).GT.CRMAX(JXP)) IFIX=1                      HP  823
      IPS=IFIX                                                          HP  824
  104 CONTINUE                                                          HP  825
C***  RESET MATRICES                                                    HP  826
      IF (IFIX.EQ.0) GO TO 107                                          HP  827
      DO 105 JL=1,NXDD                                                  HP  828
  105 BX(JL)=BXS(JL)                                                    HP  829
      DO 106 JL=1,IP                                                    HP  830
  106 CC(JL)=CCX(JL)                                                    HP  831
      GO TO 99                                                          HP  832
C***  APPLY DELTAS TO POWER, DRAG, AND LIFT COEFFICIENTS                HP  833
  107 WRITE (JWRITE,108) FIX                                            HP  834
  108 FORMAT (1X,//,34X,'PREVIOUS COEFFICIENT',8X,F4.2,'*DELTA',9X,'NEW HP  835
     1COEFFICIENT',//)                                                  HP  836
      JJ=0                                                              HP  837
      NLCK=0                                                            HP  838
      DO 119 JXP=1,NEQ                                                  HP  839
      LLOC(JXP)=JLOC(JXP)                                               HP  840
      NLOC(JXP)=0                                                       HP  841
      XX=0.0D0                                                          HP  842
      BS(JXP)=0.0D0                                                     HP  843
      ICK=1                                                             HP  844
      IF (CFM(JXP).EQ.0.0D0.OR.JLOC(JXP).NE.0) GO TO 115                HP  845
      ICK=0                                                             HP  846
      JJ=JJ+1                                                           HP  847
      XX=Y(JJ,1)*DSL(JJ)                                                HP  848
      IF (JXP.EQ.12) TC12=XX                                            HP  849
      IF (DABS(XX/CFM(JXP)).LT.1.5D-06.OR.DABS(CFM(JXP)+FIX*XX).LT.3.0D- HP  850
     108) XX=0.0D0                                                      HP  851
      IF (JXP.EQ.12.AND.DABS(Y(JJ,1)*DSL(JJ)/CFM(JXP)).LT.1.5D-06) XX=1.0 HP  852
     1D-03                                                              HP  853
      IF (XX.NE.0.0D0) GO TO 109                                        HP  854
      ICK=1                                                             HP  855
      NLOC(JXP)=1                                                       HP  856
      JLOC(JXP)=1                                                       HP  857
      NLCK=NLCK+1                                                       HP  858
      XX=Y(JJ,1)*DSL(JJ)                                                HP  859
  109 BS(JXP)=FIX*XX                                                    HP  860
      CHLD=CFM(JXP)                                                     HP  861
      CFM(JXP)=CFM(JXP)+BS(JXP)                                         HP  862
      IF (METRIC.NE.0) GO TO 112                                        HP  863
      IF (ICK.EQ.0) WRITE (JWRITE,110) CHLD,FIX,XX,CFM(JXP)             HP  864
      IF (ICK.NE.0) WRITE (JWRITE,111) CHLD,FIX,XX,CFM(JXP)             HP  865
  110 FORMAT (34X,D20.13,' + ',F4.2,'*',D15.8,' = ',D20.13)             HP  866
  111 FORMAT (34X,D20.13,' + ',F4.2,'*',D15.8,' = ',D20.13,3X,' (FROZEN)' HP  867
     1)                                                                 HP  868
      GO TO 119                                                         HP  869
  112 IF (JXP.GT.5) GO TO 113                                           HP  870
      CXH=CHLD*1.355818D-3                                              HP  871
      XX=XX*1.355818D-3                                                 HP  872
      CXY=CFM(JXP)*1.355818D-3                                          HP  873
      GO TO 114                                                         HP  874
  113 CXH=CHLD                                                          HP  875
      CXY=CFM(JXP)                                                      HP  876
  114 IF (ICK.EQ.0) WRITE (JWRITE,110) CXH,FIX,XX,CXY                   HP  877
      IF (ICK.NE.0) WRITE (JWRITE,111) CXH,FIX,XX,CXY                   HP  878
      GO TO 119                                                         HP  879
  115 IF (METRIC.NE.0) GO TO 116                                        HP  880
      WRITE (JWRITE,111) CFM(JXP),FIX,XX,CFM(JXP)                       HP  881
      GO TO 119                                                         HP  882
  116 IF (JXP.GT.5) GO TO 117                                           HP  883
      CXH=CFM(JXP)*1.355818D-3                                          HP  884
      CXY=CFM(JXP)*1.355818D-3                                          HP  885
      GO TO 118                                                         HP  886
  117 CXH=CFM(JXP)                                                      HP  887
      CXY=CXH                                                           HP  888
  118 WRITE (JWRITE,111) CXH,FIX,XX,CXY                                 HP  889
  119 CONTINUE                                                          HP  890
C***  CHECK FOR ADJUSTMENT TO MATRICES DUE TO COEFFICIENT FREEZING      HP  891
      IF (NLCK.EQ.0.OR.NLCK.GT.(JJ-2)) GO TO 128                        HP  892
      DO 120 JXP=1,NEQ                                                  HP  893
      IF (JXP.EQ.12.AND.BS(JXP).EQ.1.0D-03) CFM(12)=CFM(12)+1.0D-03     HP  894
      IF (JXP.EQ.12.AND.(CFM(JXP).GT.6.296D0.AND.TC12.GT.0.0D0)) CFM(JXP) HP  895
     1=CFM(JXP)+3.0D-03                                                 HP  896
  120 CFM(JXP)=CFM(JXP)-BS(JXP)*(1-NLOC(JXP))                           HP  897
      DO 121 II=1,10                                                    HP  898
  121 IF (CFM(12).GT.CRMAX(12)) CFM(12)=CFM(12)-1.0D-03                 HP  899
C***  ADJUST MATRICES                                                   HP  900
      CALL ADJUST(ZM,YS,CFM,Y,DSL,LLOC,NLOC,IP,NEQ)                     HP  901
      WRITE (JWRITE,108) FIX                                            HP  902
C***  COMPUTE NEW ADJUSTED DELTAS                                       HP  903
      CALL LLSQAR(ZM,YS,IP,IP,1,13,13,15,WKAR,IER,JWRITE)               HP  904
C***  TEST FOR ERROR                                                    HP  905
      IF (IER.EQ.129) IERR=1                                            HP  906
      IF (IERR.NE.0) RETURN                                             HP  907
C***  APPLY DELTAS                                                      HP  908
      JJ=0                                                              HP  909
      DO 127 JXP=1,NEQ                                                  HP  910
      XX=0.0D0                                                          HP  911
      ICK=1                                                             HP  912
      IF (CFM(JXP).EQ.0.0D0.OR.(((JLOC(JXP).EQ.LLOC(JXP)).AND.JLOC(JXP). HP  913
     1NE.0).OR.NLOC(JXP).NE.0)) GO TO 122                               HP  914
```

```
      ICK=0                                                              HP  915
      JJ=JJ+1                                                            HP  916
      XX=FXX*YS(JJ,1)*SCALE(JXP)                                         HP  917
      CHLD=CFN(JXP)                                                      HP  918
  122 CFN(JXP)=CFN(JXP)+XX                                               HP  919
      IF (METRIC.NE.0) GO TO 123                                         HP  920
      IF (ICK.EQ.0) WRITE (JWRITE,110) CHLD,FXX,XX,CFN(JXP)              HP  921
      IF (ICK.NE.0) WRITE (JWRITE,111) CFN(JXP),FXX,XX,CFN(JXP)          HP  922
      GO TO 127                                                          HP  923
  123 IF (JXP.GT.5) GO TO 125                                            HP  924
      CXH=CHLD*1.355818D-3                                               HP  925
      XX=XX*1.355818D-3                                                  HP  926
      CXX=CFN(JXP)*1.355818D-3                                           HP  927
      GO TO 126                                                          HP  928
  125 CXH=CHLD                                                           HP  929
      CXX=CFN(JXP)                                                       HP  930
  126 IF (ICK.EQ.0) WRITE (JWRITE,110) CXH,FXX,XX,CXX                    HP  931
      IF (ICK.NE.0) WRITE (JWRITE,111) CXX,FXX,XX,CXX                    HP  932
  127 CONTINUE                                                           HP  933
C***  START NEW ITERATION OR CONTINUE                                    HP  934
  128 ICNT=0                                                             HP  935
      DO 129 JXP=1,NEQ                                                   HP  936
      HCFN(LKK+1,JXP)=CFN(JXP)                                           HP  937
  129 IF (CFN(JXP).NE.0.0D0.AND.JLOC(JXP).NE.0)ICNT=ICNT+1               HP  938
      IF ((NUM-ICNT).LE.2) GO TO 133                                     HP  939
      GO TO 3                                                            HP  940
C***  READJUST COEFFICIENTS DUE TO TOLERANCE INCREASE                    HP  941
  130 DO 131 JXP=1,NEQ                                                   HP  942
  131 CFN(JXP)=HCFN(LKK-2,JXP)                                           HP  943
C***  RESET PARAMETERS WITH RESPECT TO BEST TOLERANCE                    HP  944
      DO 132 IG=1,N                                                      HP  945
      F1(IG)=XHLD(1,IG)                                                  HP  946
      F5(IG)=XHLD(2,IG)                                                  HP  947
  132 F6(IG)=XHLD(3,IG)                                                  HP  948
C***  MAKE ADJUSTMENT TO PITCH ANGLE                                     HP  949
  133 DO 134 I=1,N                                                       HP  950
  134 F2(I)=F6(I)+DARSIN(F11(I)/F4(I))                                   HP  951
      RETURN                                                             HP  952
      END                                                                HP  953
```

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Flowchart – FDR2



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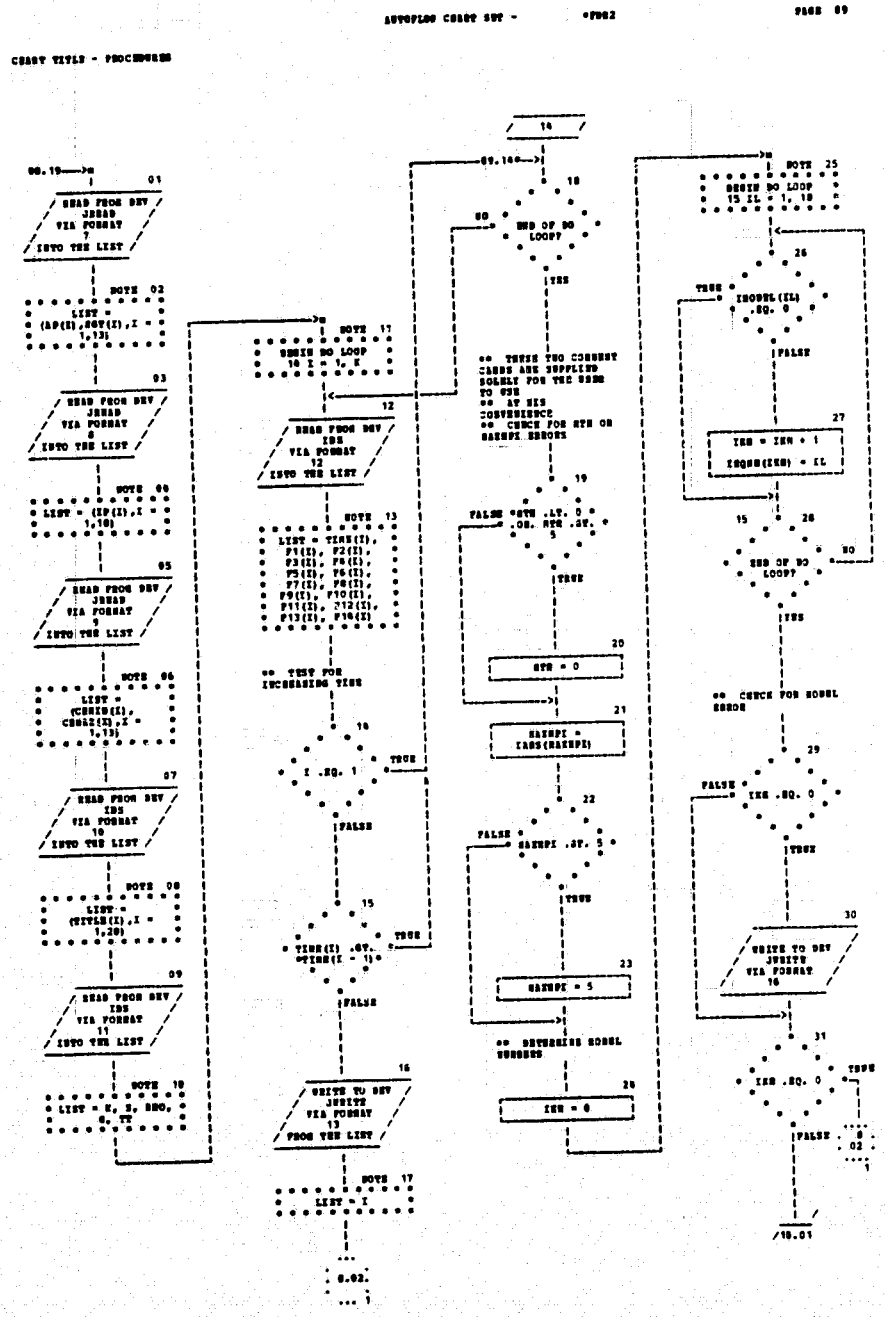
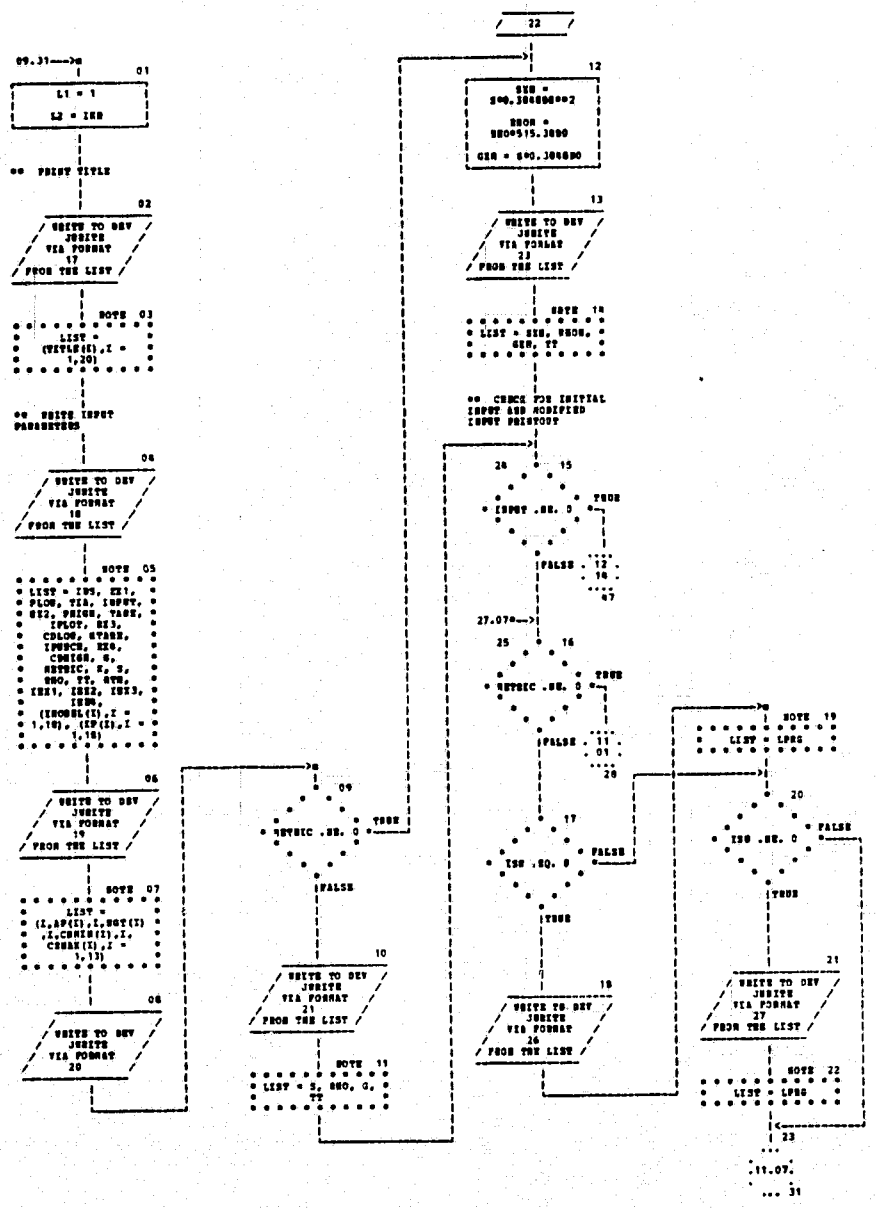


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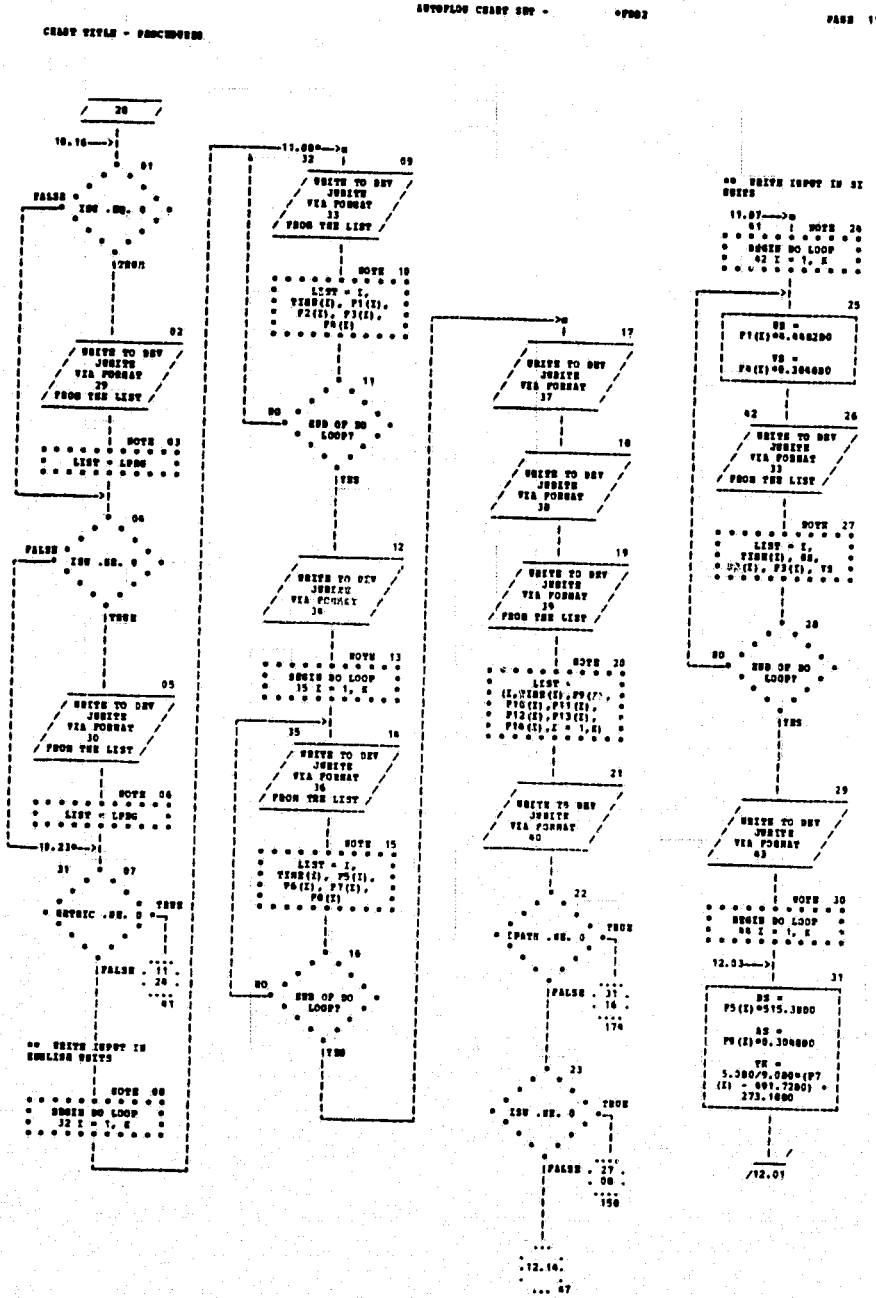
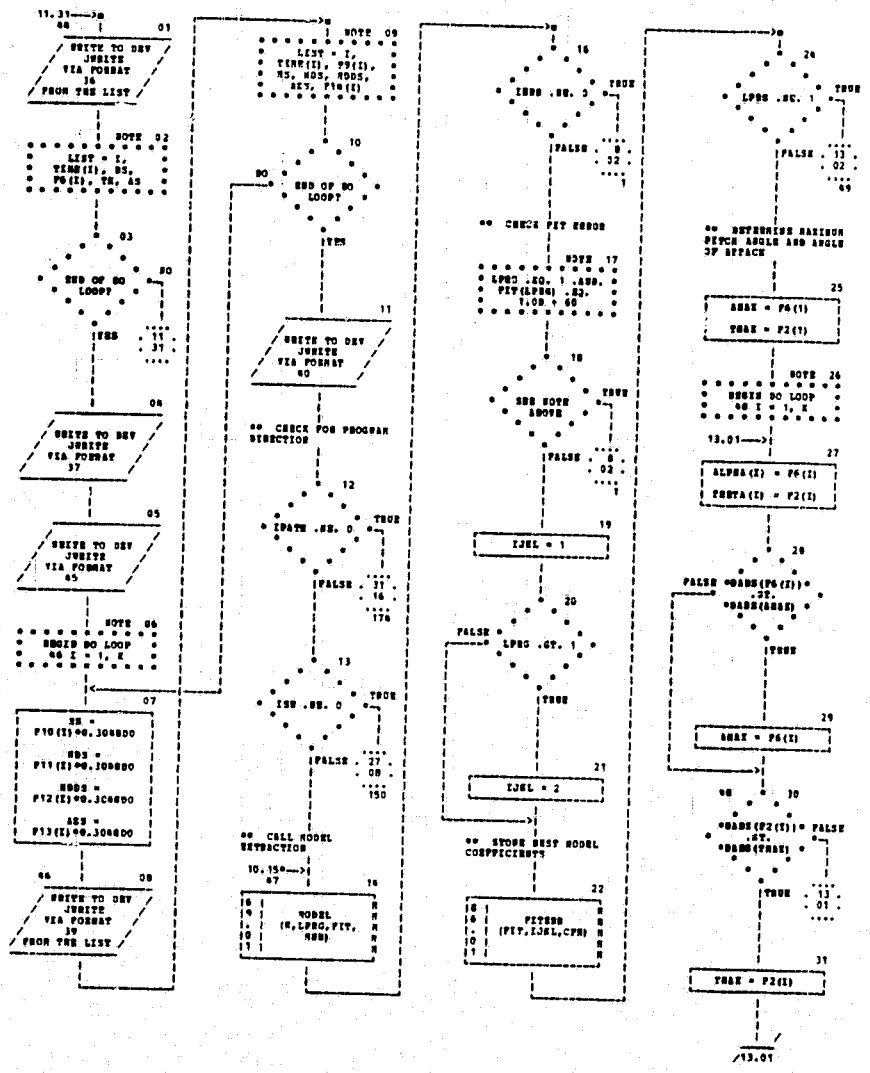


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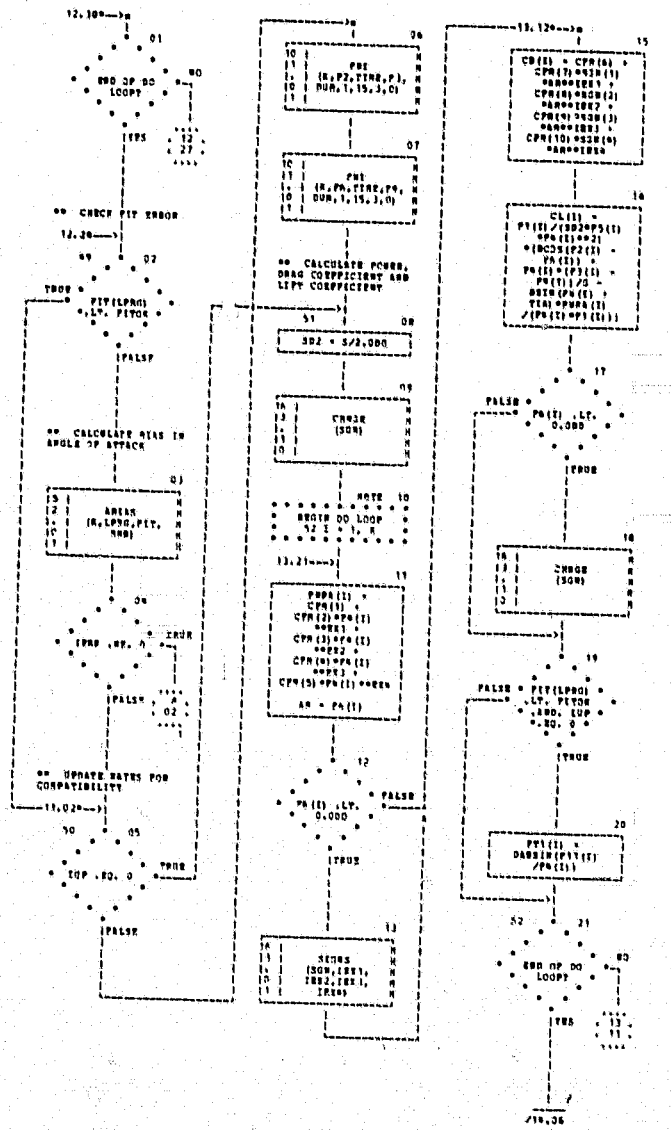
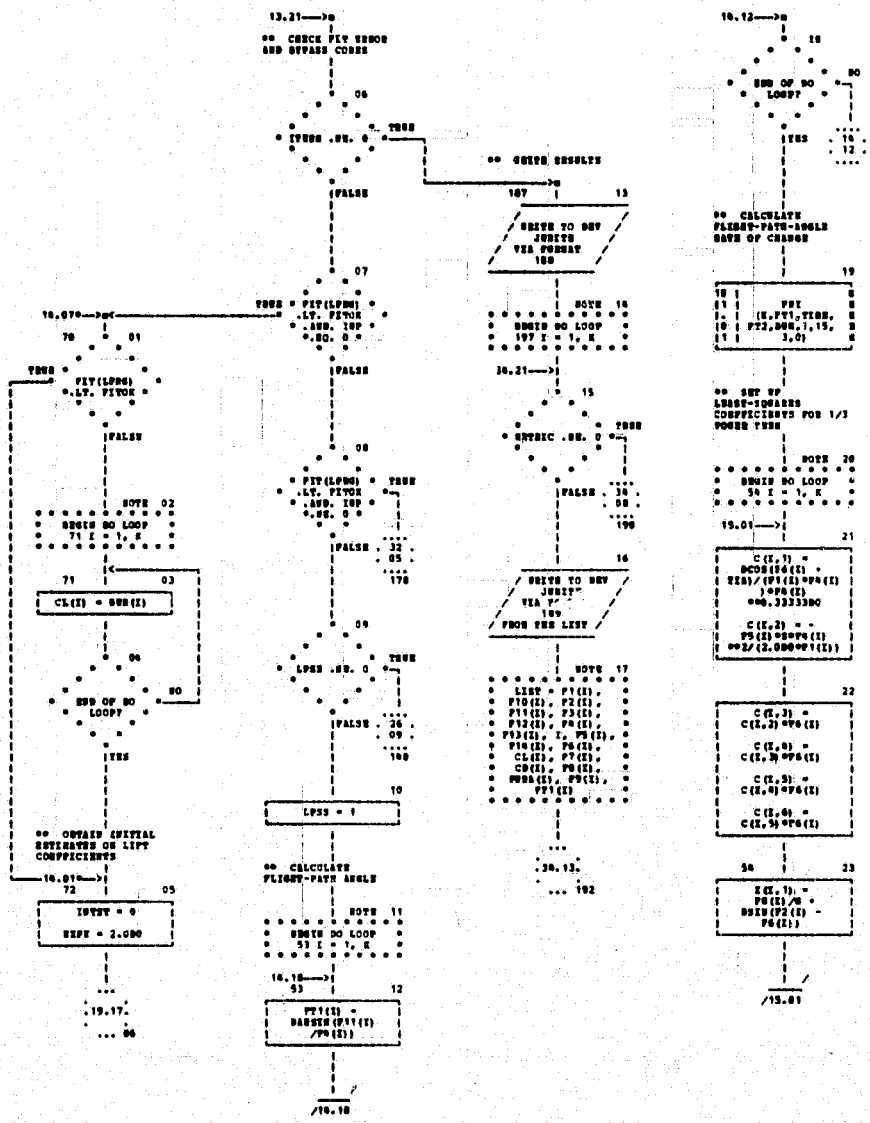


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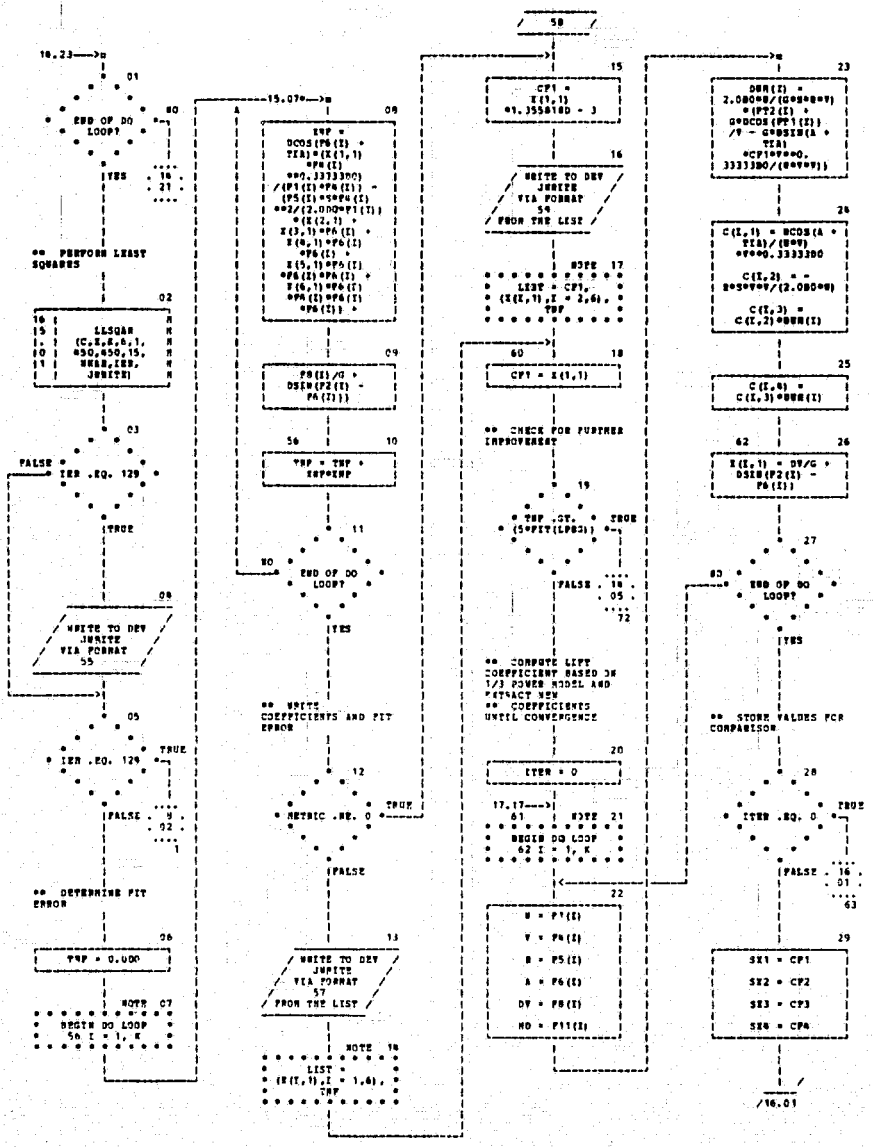
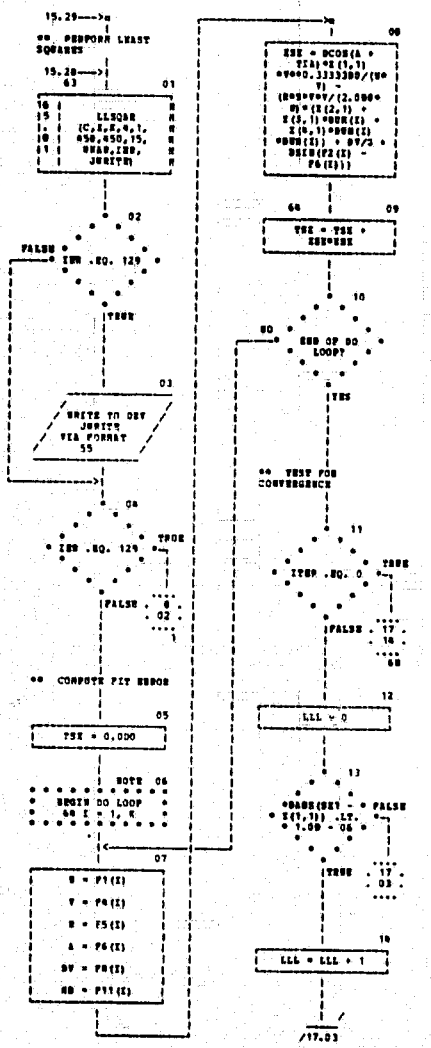
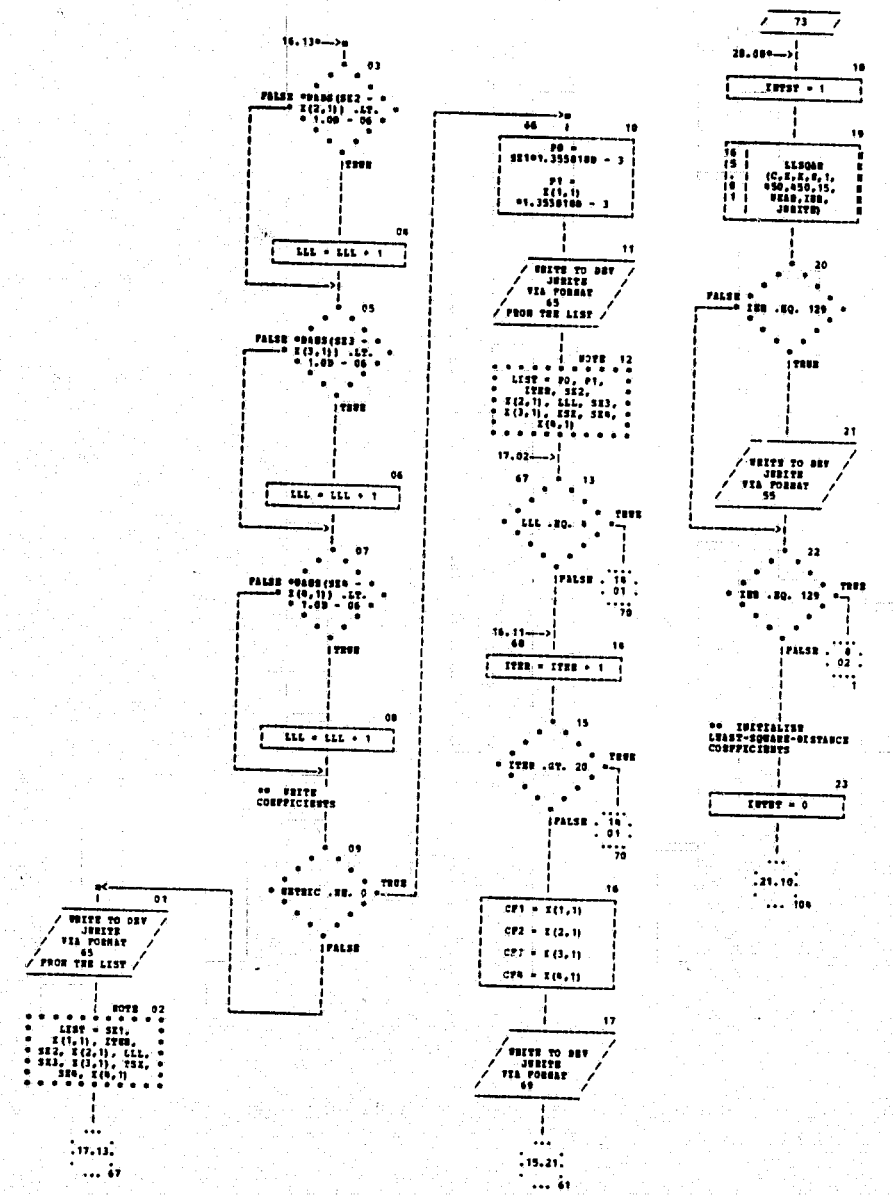


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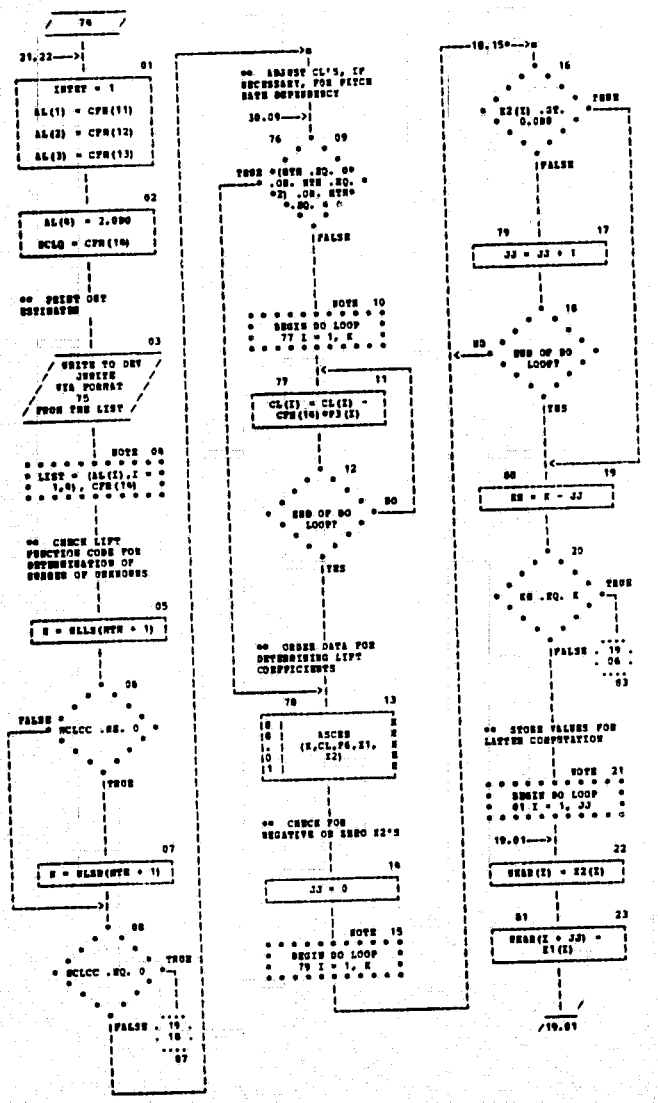


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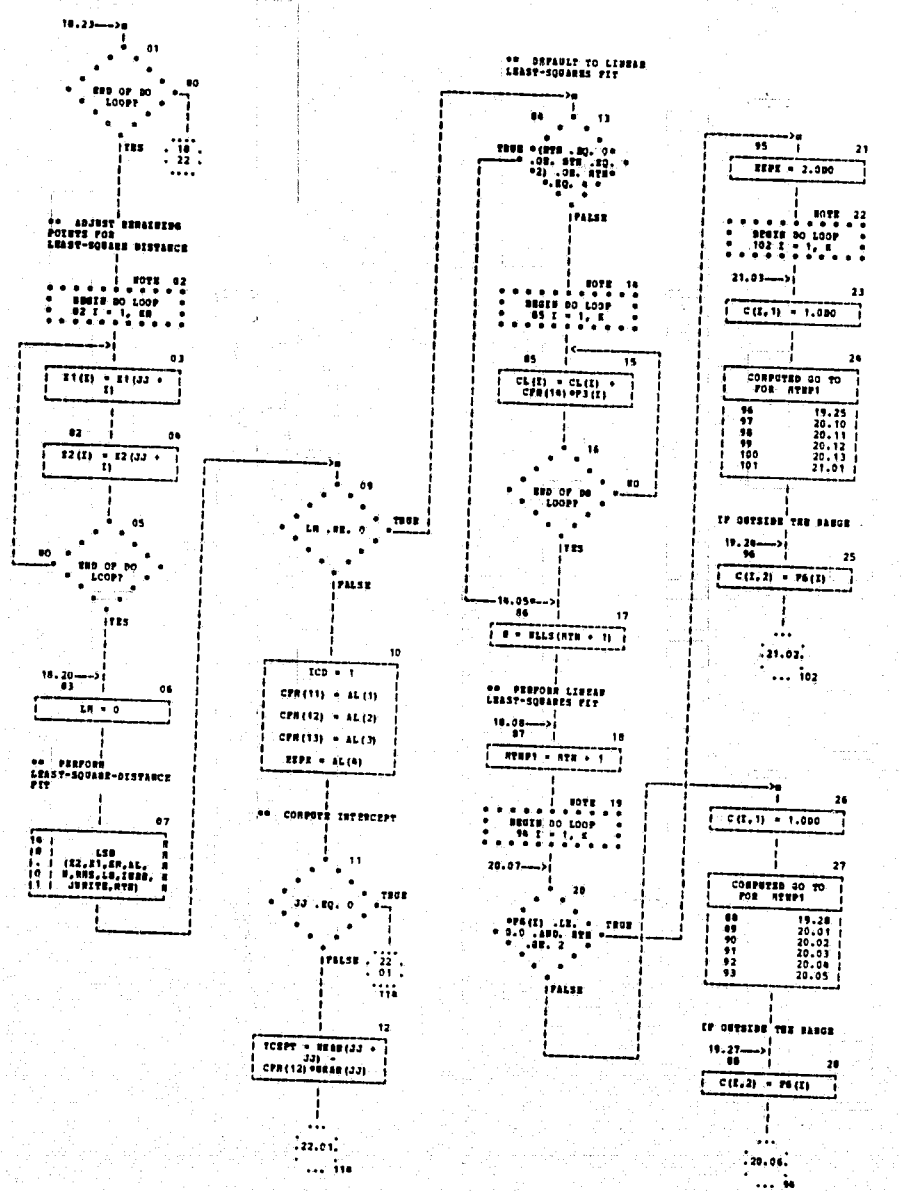
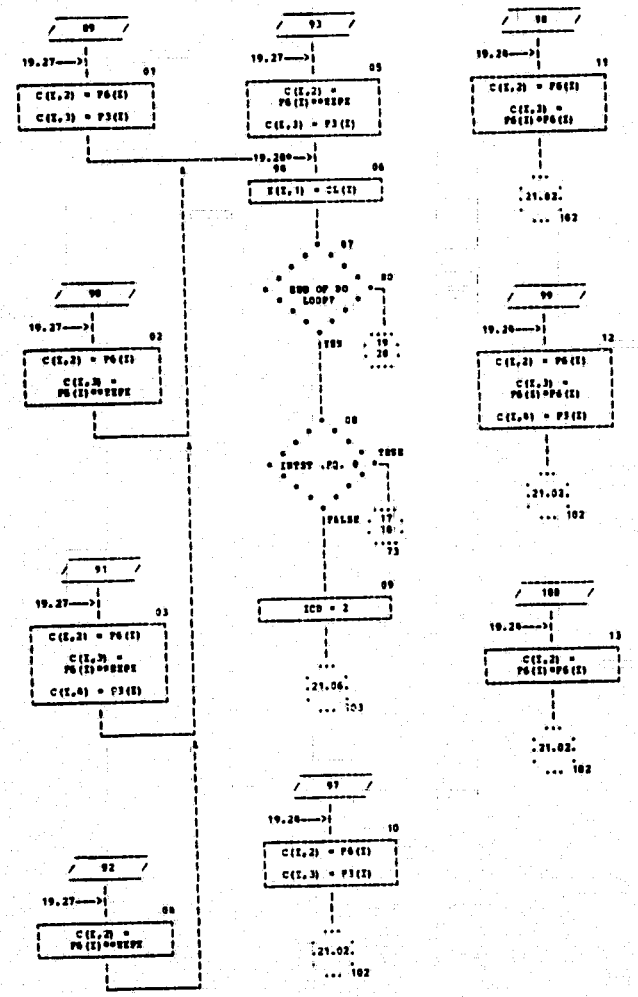


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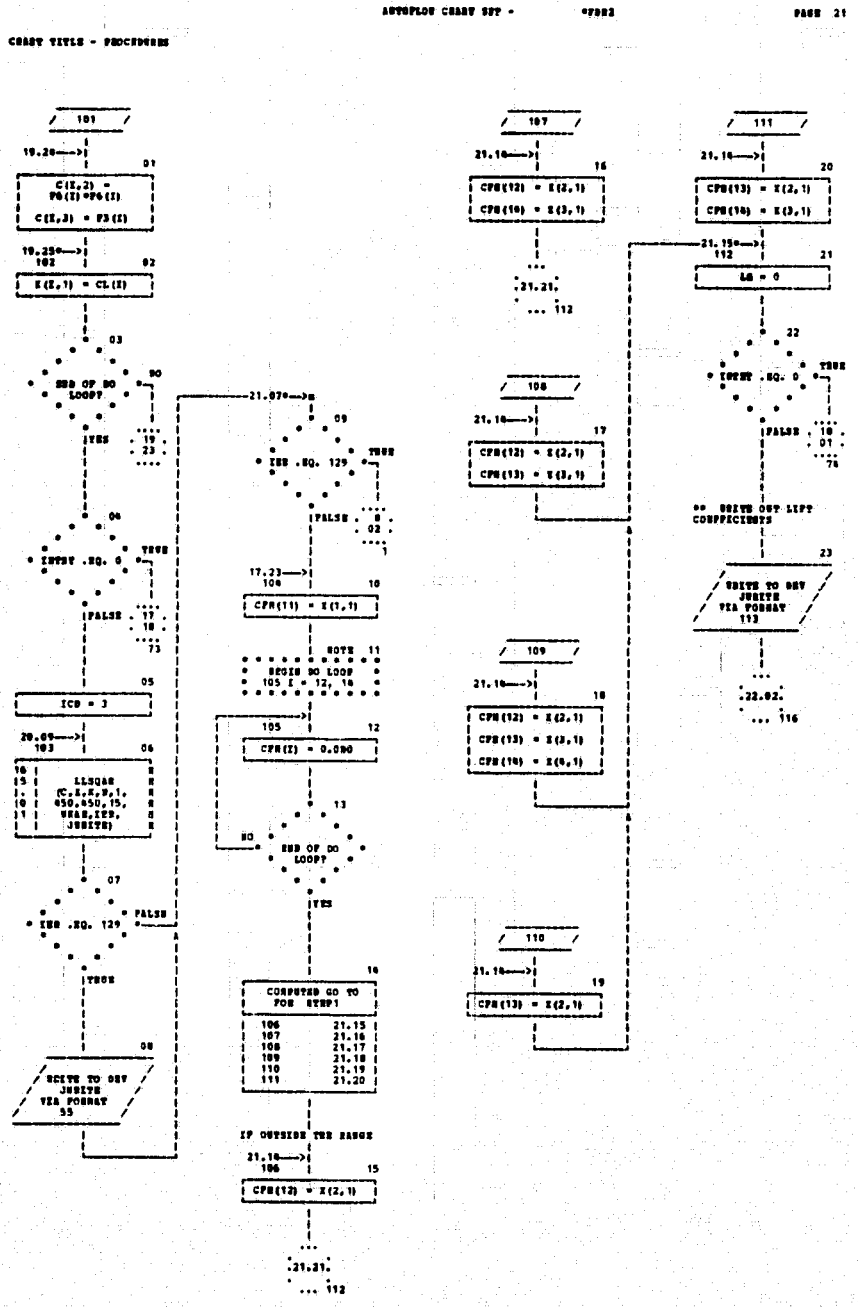


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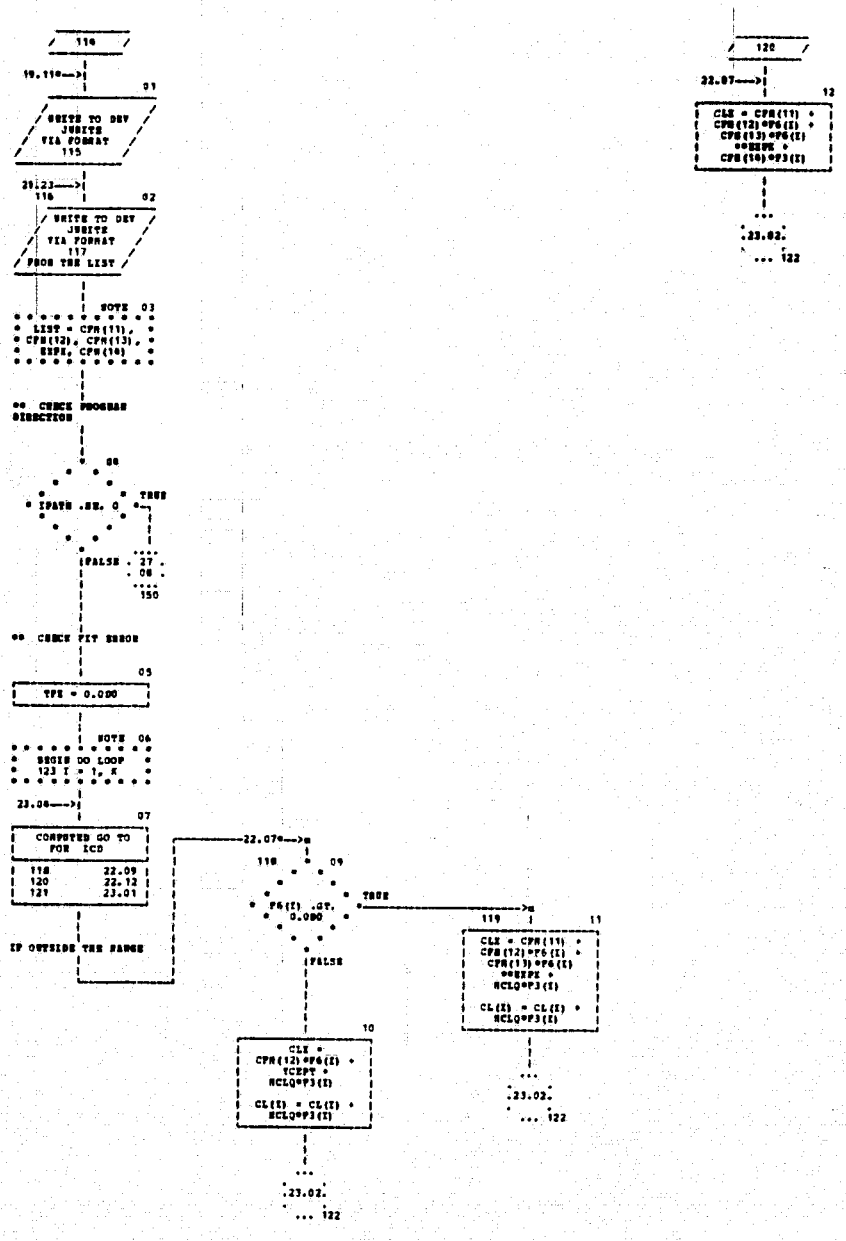
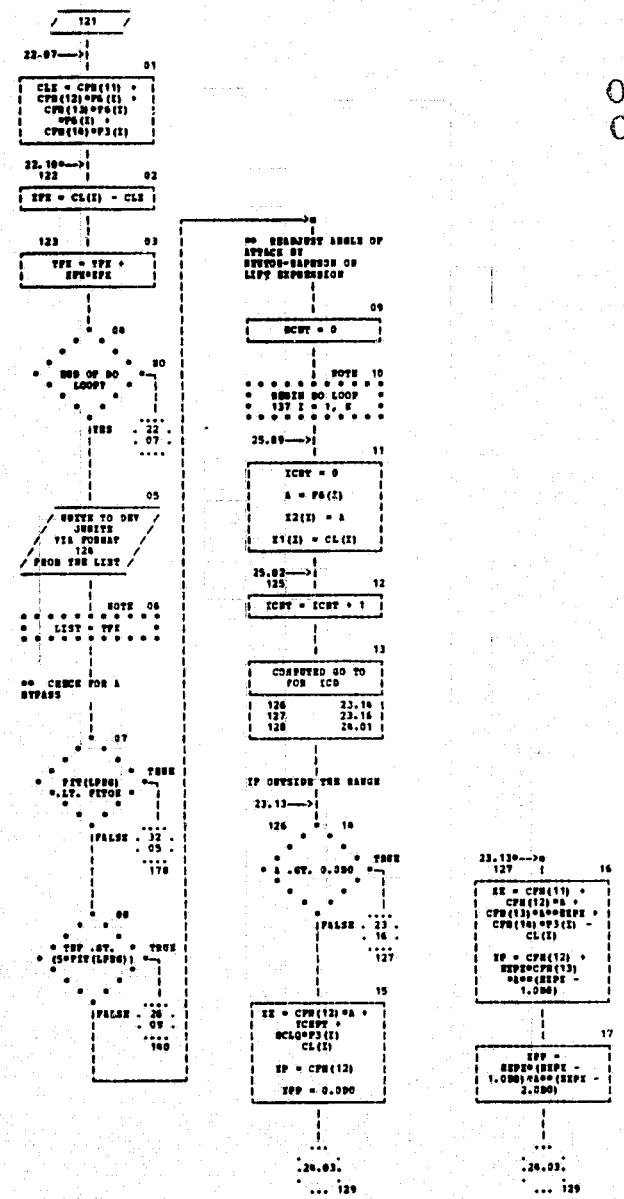
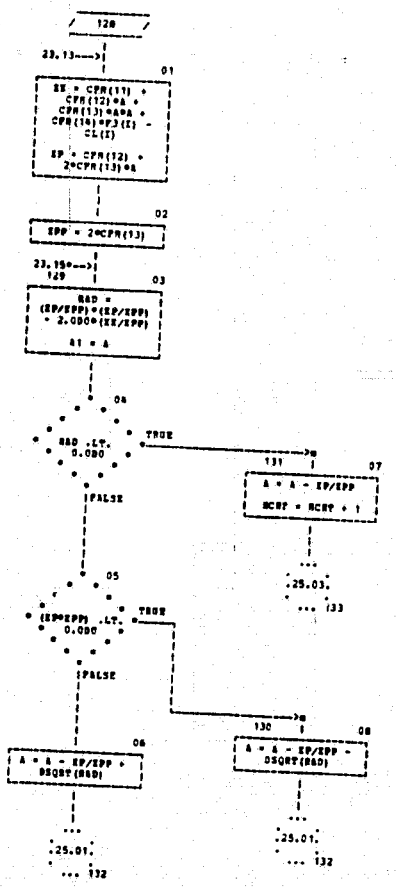


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128
23,13
01
EE = CPR(11) + CPR(12)*A + CPR(13)*APA + CPR(14)*P3(I) - CL(I)
EP = CPR(12) + 2*CPR(13)*A
02
EPP = 2*CPR(13)
23,15
129
03
RAD = (EP/EPP)*(EP/EPP) + 2.000*(EE/EPP)
A1 = A
04
RAD .LT. 0.000
TRUE
131
07
A = A - EP/EPP
RCRT = RCRT + 1
.25.03.
133
FALSE
05
(EP*EPP) .LT. 0.000
TRUE
130
08
A = A - EP/EPP - DSQRT(RAD)
.25.01.
132
FALSE
06
A = A - EP/EPP + DSQRT(RAD)
.25.01.
132

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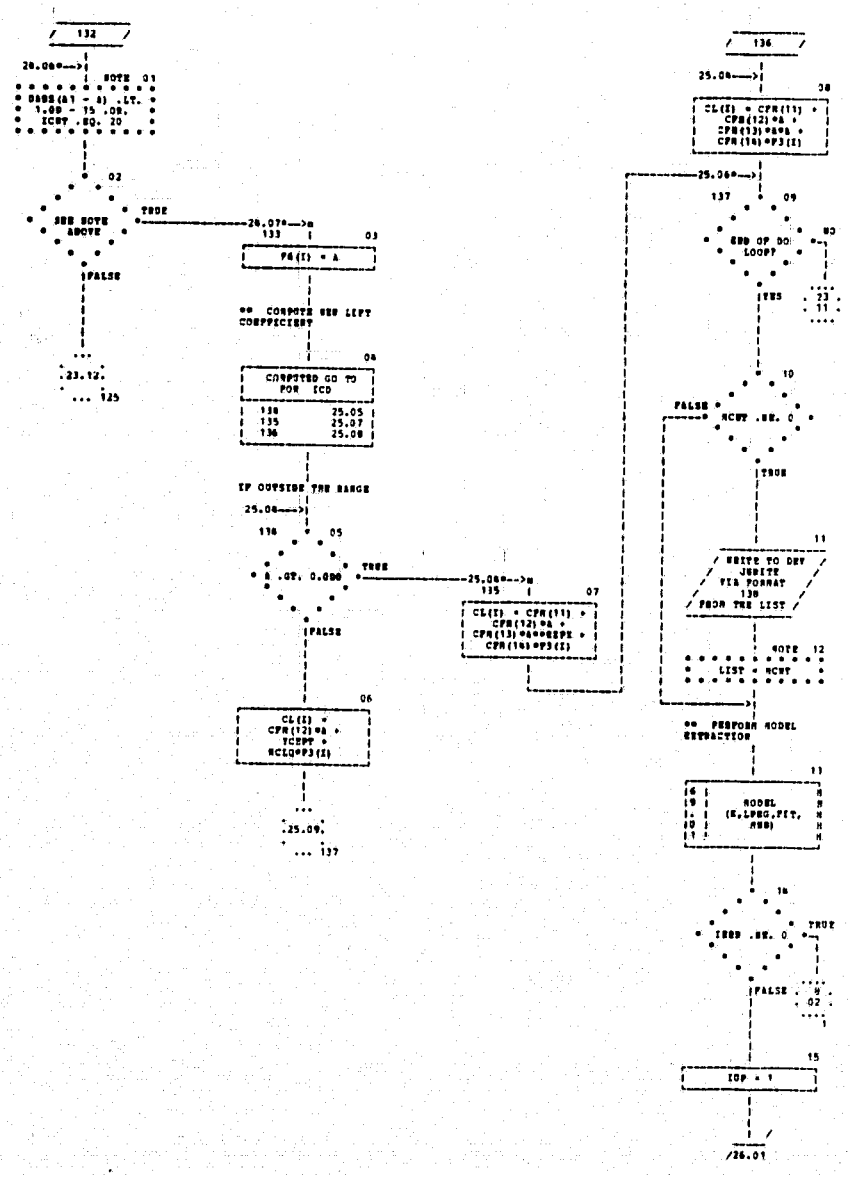
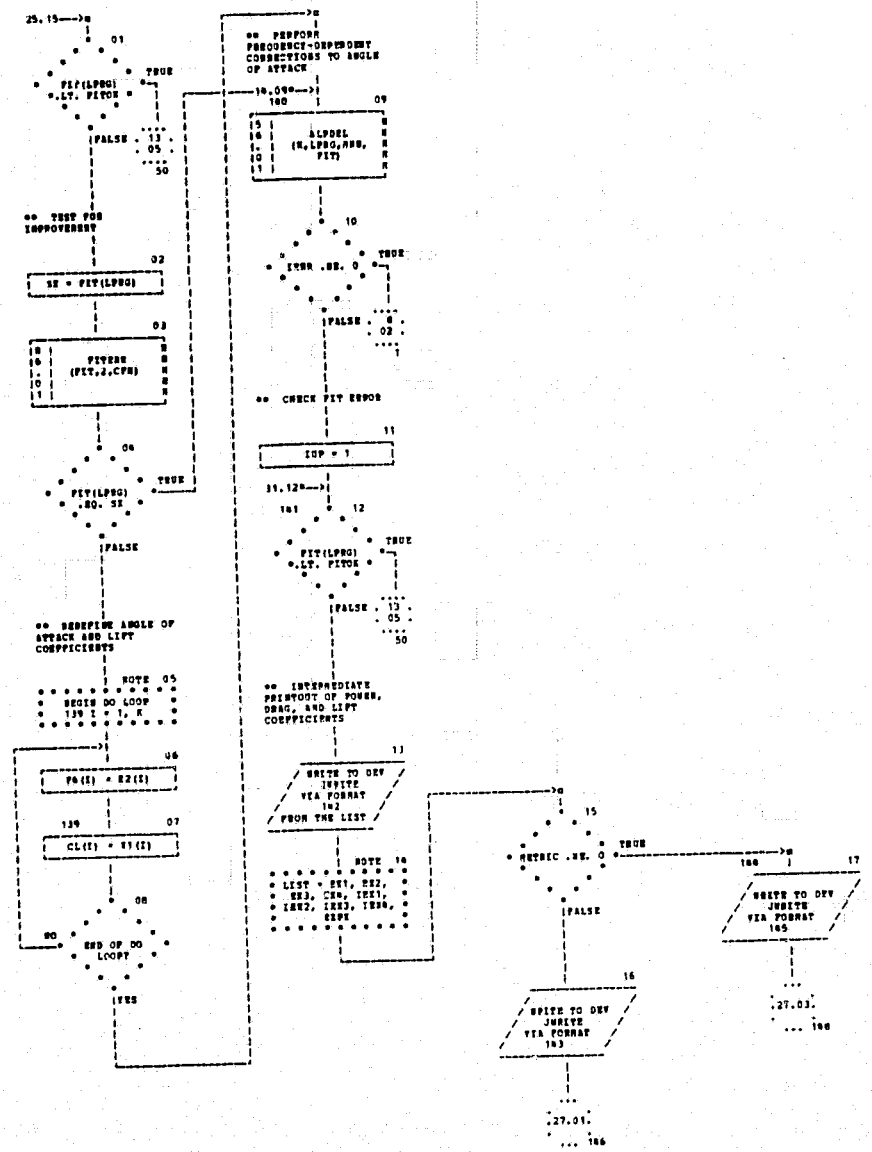
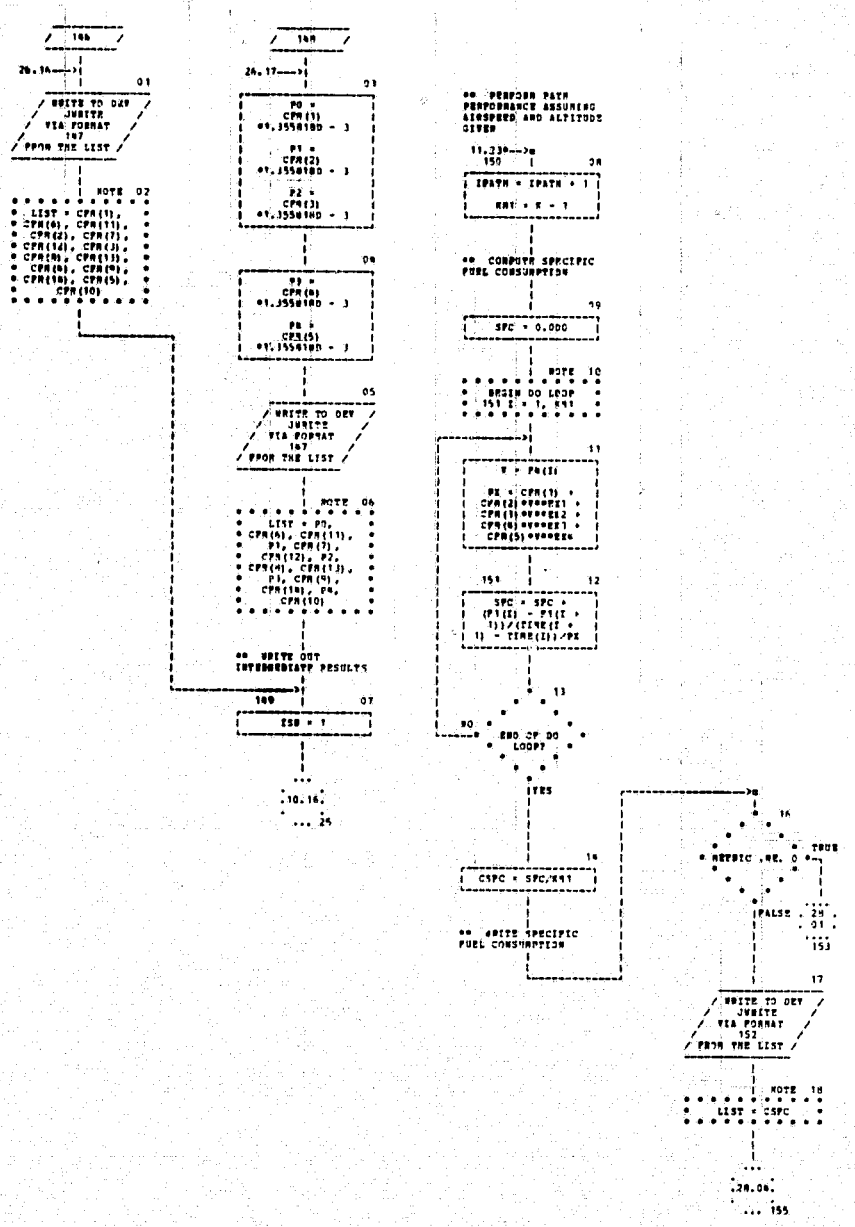


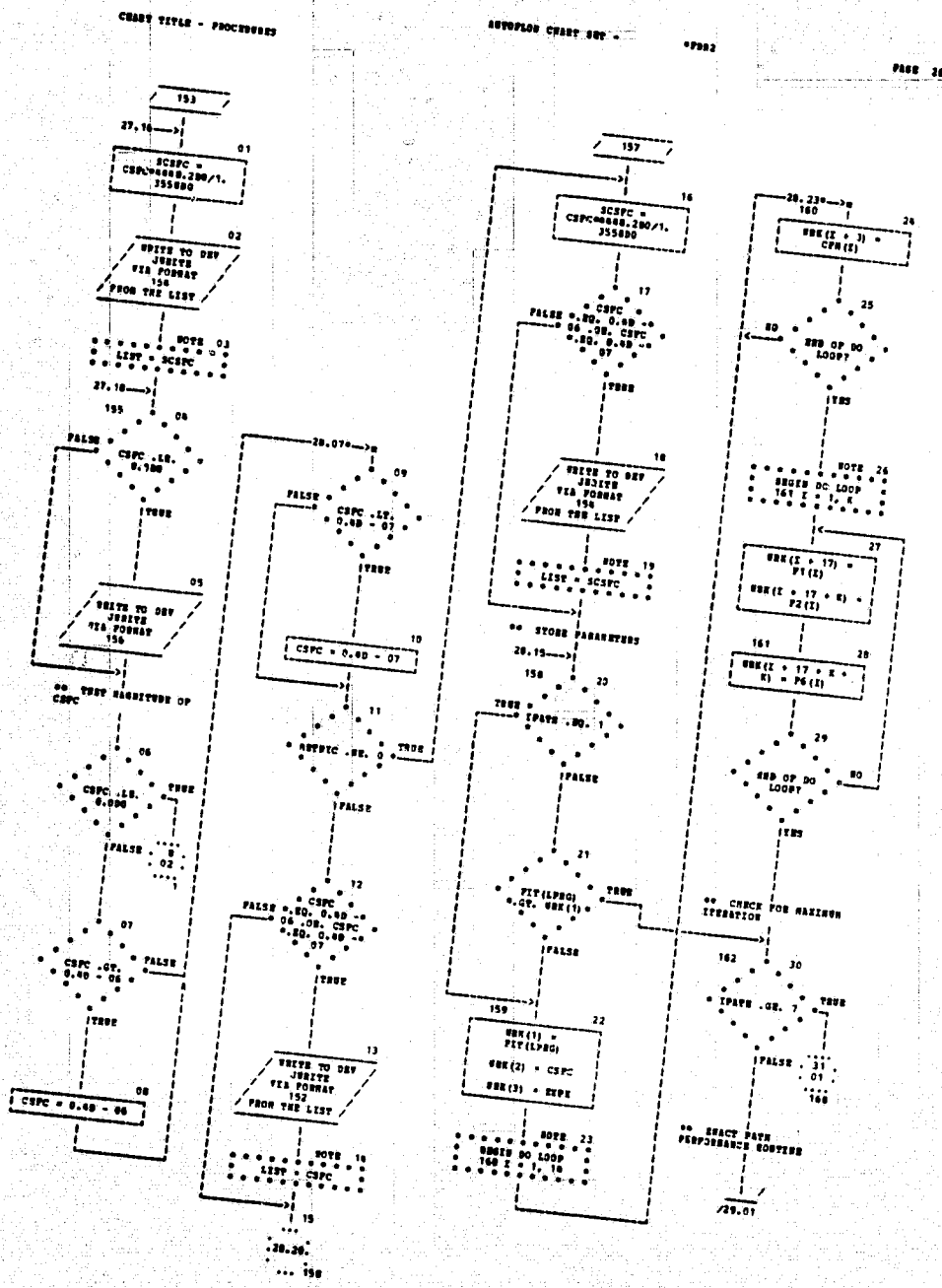
CHART TITLE - PROCEDURES



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CHART TITLE - PROCEDURES




CHART TITLE - PROCEDURE2
AUTOFLOW CHART SUB -
*PRR2
PAGE 38
153
27,16
01
SCSPC =
CSPC*8648.280/1.
355880
02
WRITE TO DEV
JUNITE
VIA FORMAT
150
FROM THE LIST
MOVE 03
LIST = SCSPC
27,16
155
04
CSPC .LE.
0.100
FALSE
TRUE
05
WRITE TO DEV
JUNITE
VIA FORMAT
156
** TEST MAGNITUDE OF
CSPC
06
CSPC .LE.
0.000
TRUE
FALSE
07
CSPC .GT.
0.40 - 06
FALSE
TRUE
08
CSPC = 0.40 - 06
28,07
09
CSPC .LT.
0.80 - 07
FALSE
TRUE
10
CSPC = 0.80 - 07
11
ABSPSC .NE. 0
TRUE
FALSE
12
CSPC
FALSE 0.EQ. 0.80 -0
06 .OR. CSPC
0.EQ. 0.80 -0
07
TRUE
13
WRITE TO DEV
JUNITE
VIA FORMAT
152
FROM THE LIST
MOVE 14
LIST = CSPC
15
.28,30.
150
157
16
SCSPC =
CSPC*8648.280/1.
355880
17
CSPC
FALSE 0.EQ. 0.80 -0
06 .OR. CSPC
0.EQ. 0.80 -0
07
TRUE
18
WRITE TO DEV
JUNITE
VIA FORMAT
158
FROM THE LIST
MOVE 19
LIST = SCSPC
** STORE PARAMETERS
28,15
158
20
IPASS .EQ. 1
TRUE
FALSE
21
FIT(LPSG)
.GT. VBK(1)
TRUE
FALSE
159
22
VBK(1) =
FIT(LPSG)
VBK(2) = CSPC
VBK(3) = EXPX
MOVE 23
VBKEN DO LOOP
160 I = 1, 10
28,23
160
24
VBK(I + 3) =
CFR(I)
25
END OF DO
LOOP?
NO
YES
MOVE 26
REGEN DO LOOP
161 I = 1, K
27
VBK(I + 17) =
P1(I)
VBK(I + 17 + K) =
P2(I)
161
28
VBK(I + 17 + K +
K) = P6(I)
29
END OF DO
LOOP
NO
YES
** CHECK FOR MAXIMUM
ITERATION
162
30
IPASS .GE. 7
TRUE
FALSE
31
.01
168
** EXACT PATH
PERFORMANCE ROUTINE
/29.01

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CHART TITLE - PROCEDURE

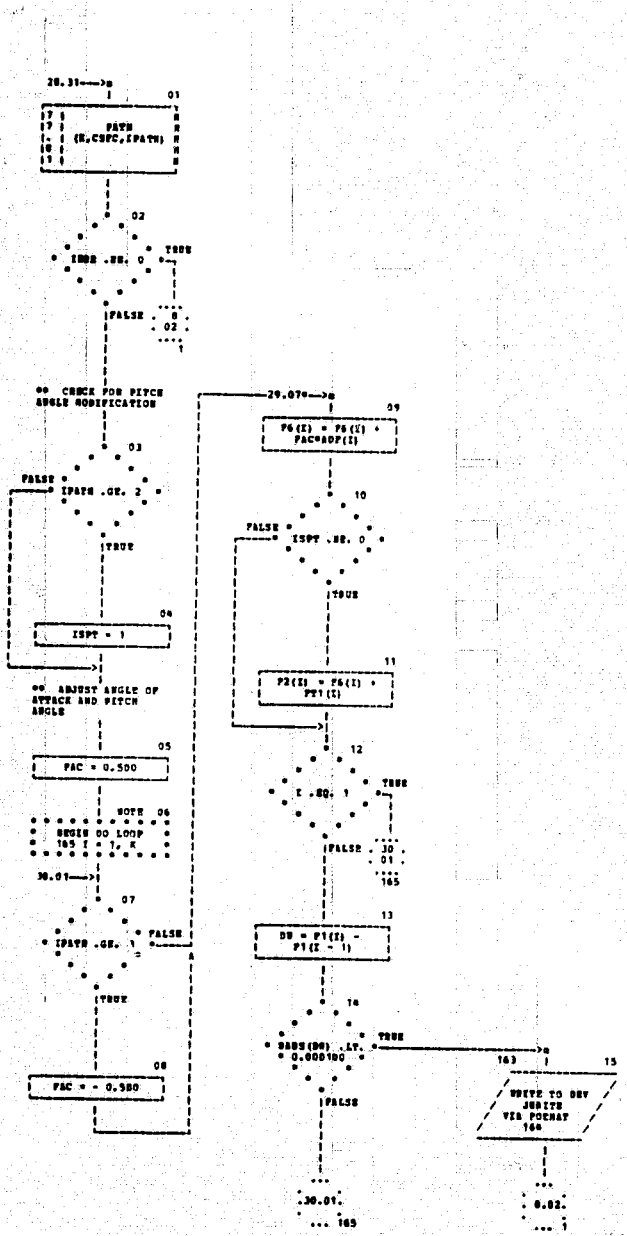
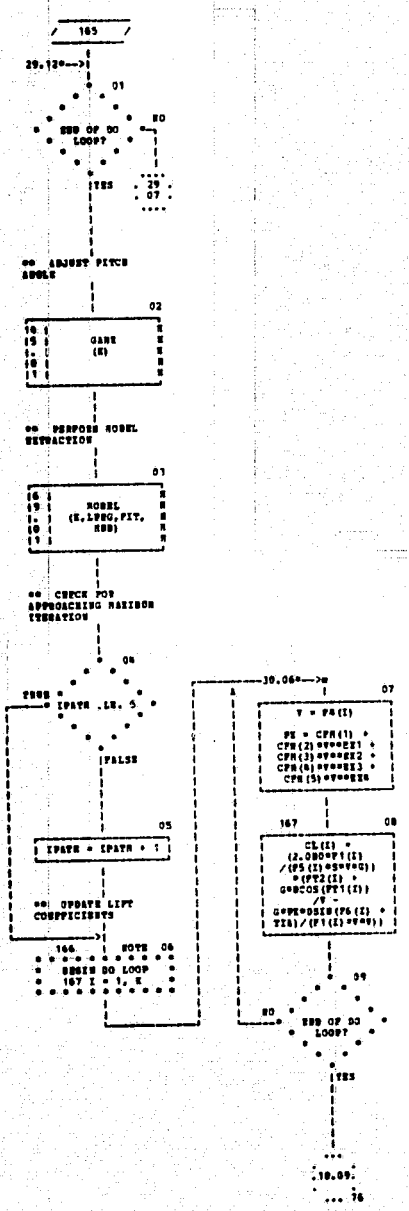


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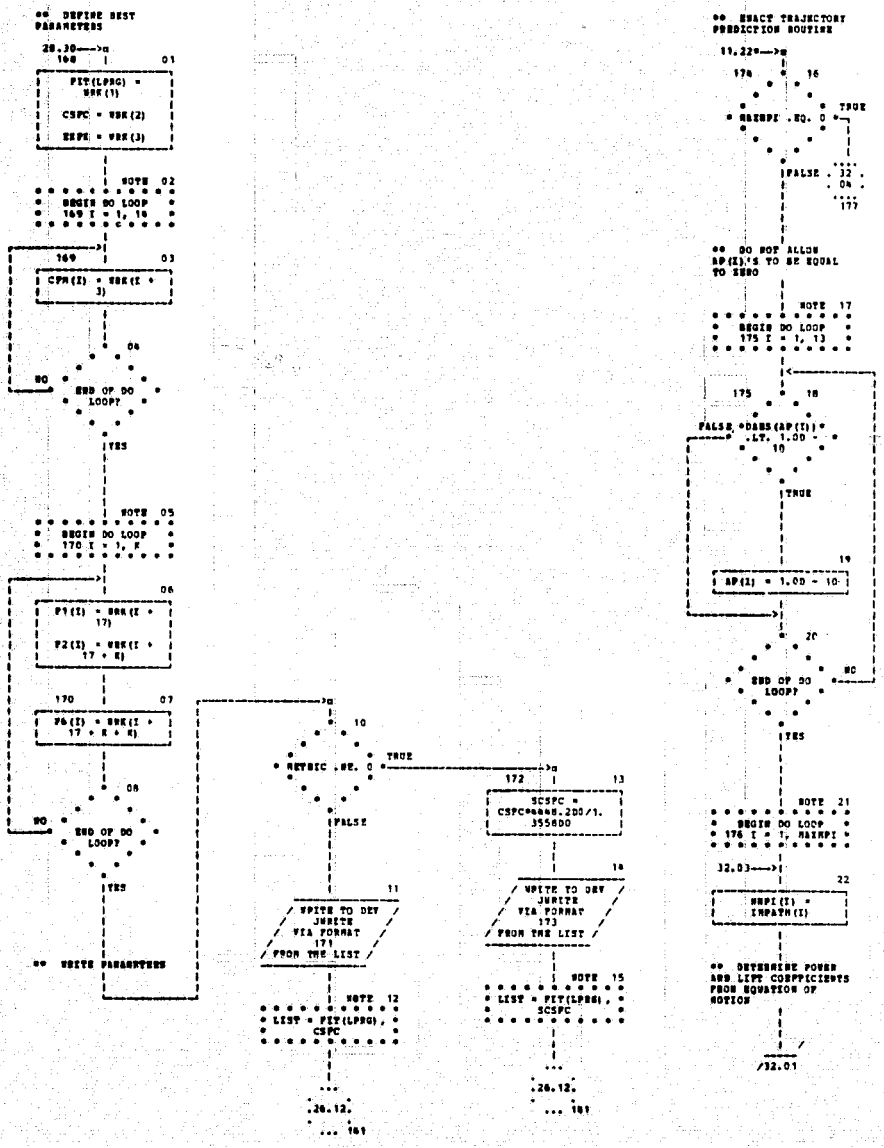
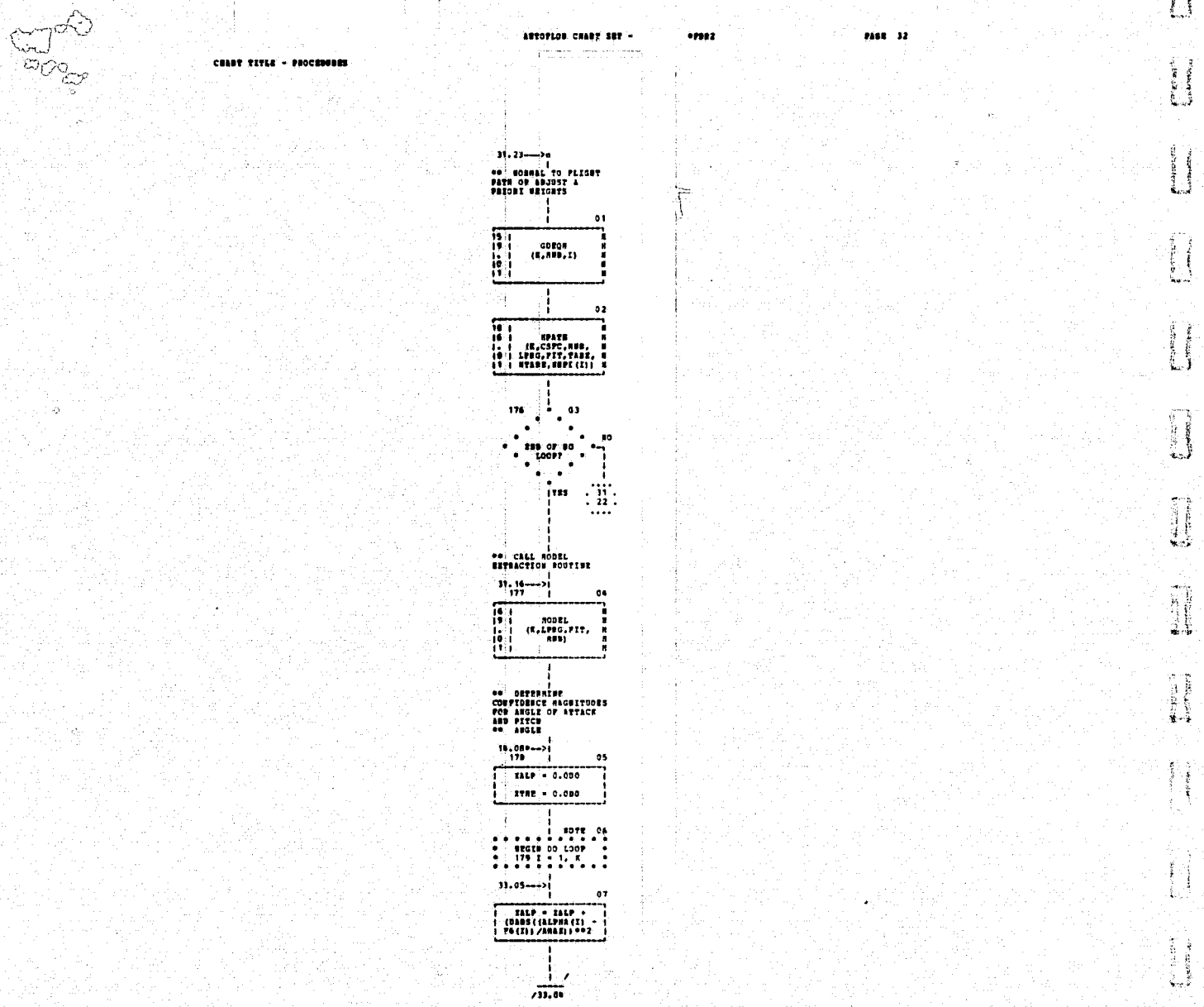
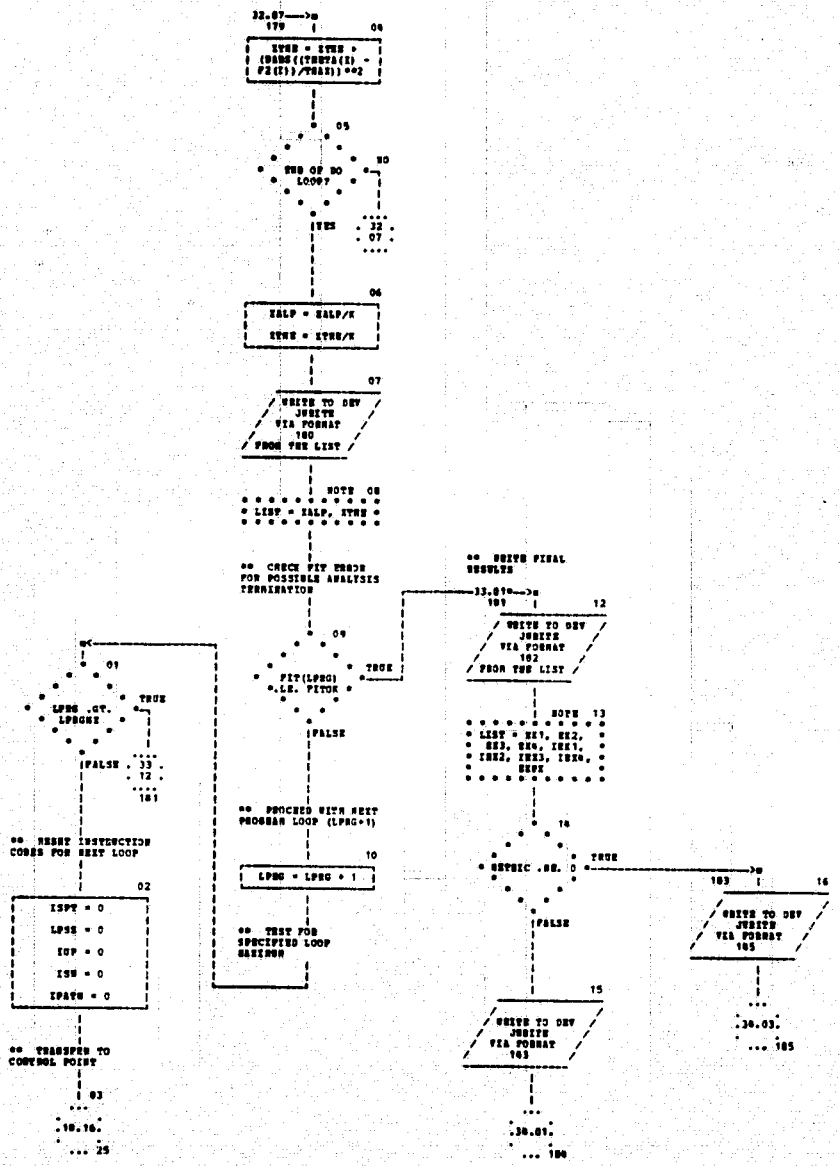


CHART TITLE - PROCEDURES



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CHART TITLE - PROCEDURE



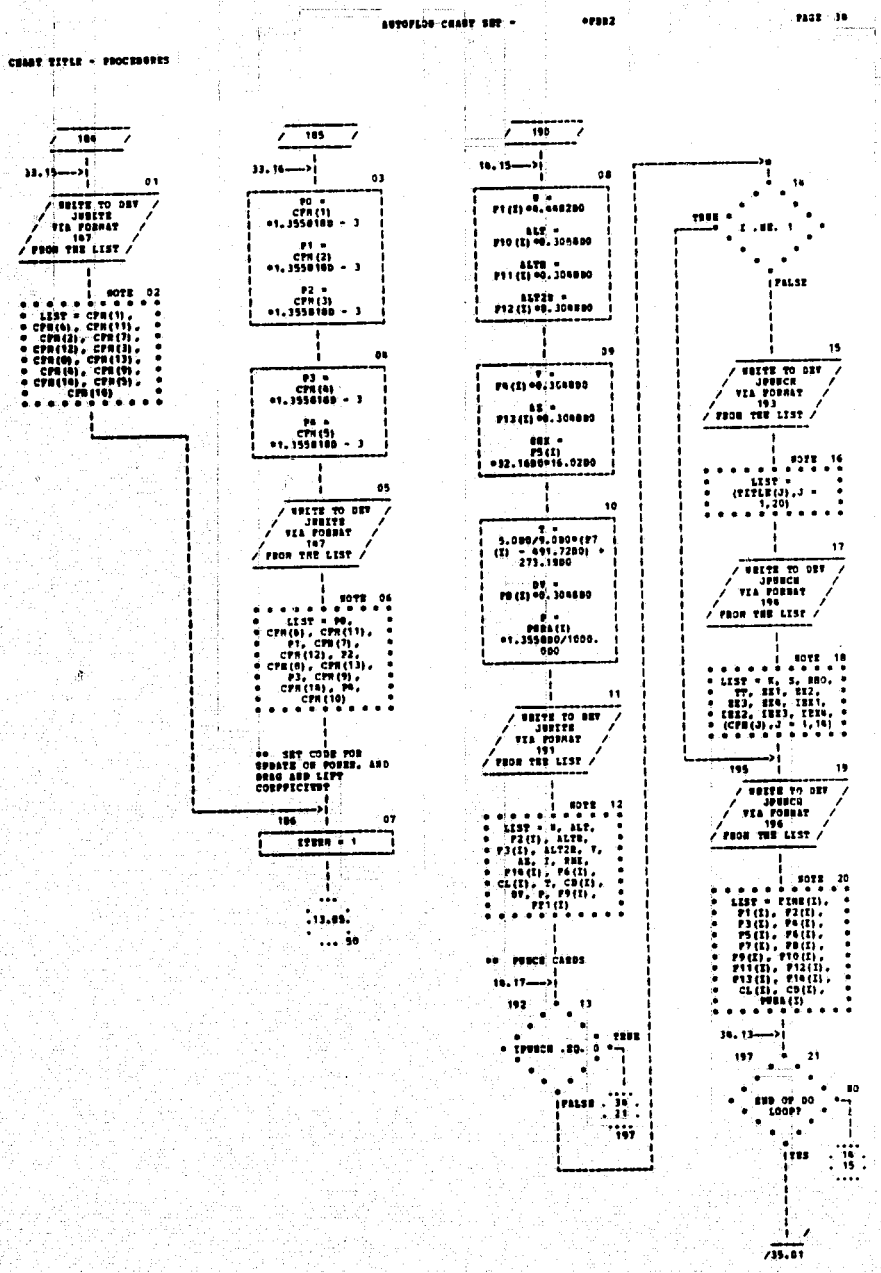
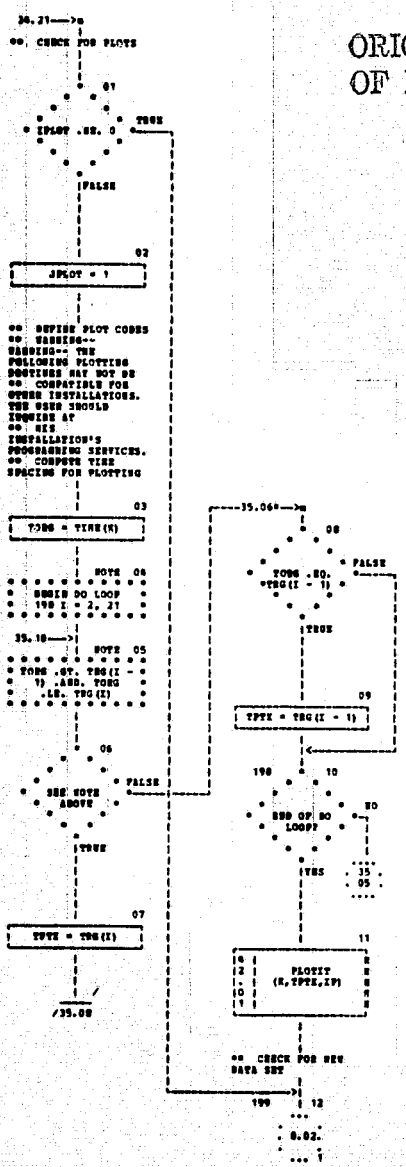
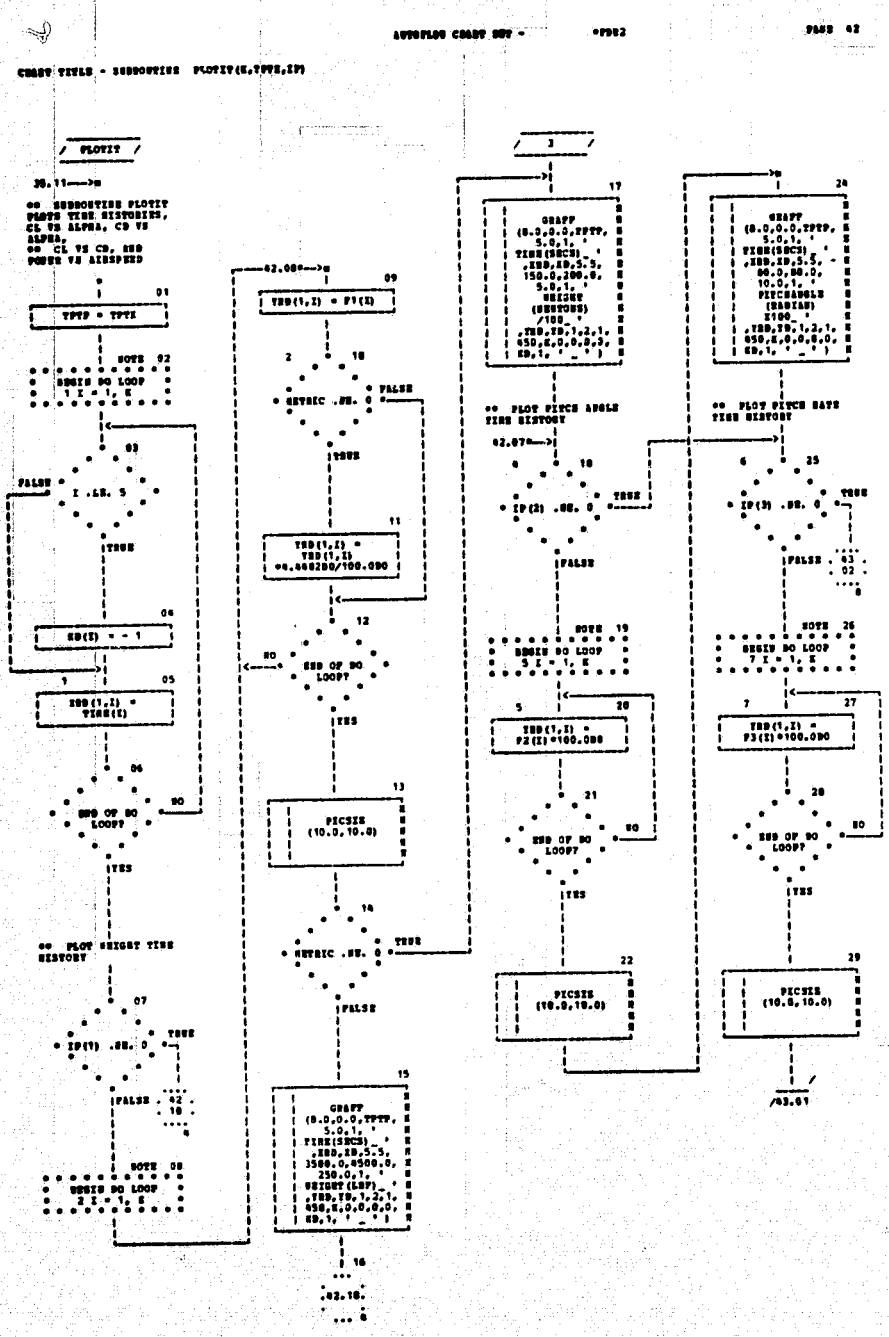

AUTOFLOW CHART SET -
PAGE 38
CHART TITLE - PROCESSORES
184
33.15
01
WRITE TO DEV
JWRITE
VIA FORMAT
187
FROM THE LIST
NOTE 02
LIST = CPR(1),
CPR(6), CPR(11),
CPR(2), CPR(7),
CPR(12), CPR(3),
CPR(8), CPR(13),
CPR(4), CPR(9),
CPR(14), CPR(5),
CPR(10)
185
33.16
03
P0 =
CPR(1)
*1.3558180 - 3
P1 =
CPR(2)
*1.3558180 - 3
P2 =
CPR(3)
*1.3558180 - 3
04
P3 =
CPR(4)
*1.3558180 - 3
P4 =
CPR(5)
*1.3558180 - 3
05
WRITE TO DEV
JWRITE
VIA FORMAT
187
FROM THE LIST
NOTE 06
LIST = P0,
CPR(6), CPR(11),
P1, CPR(7),
CPR(12), P2,
CPR(8), CPR(13),
P3, CPR(9),
CPR(14), P4,
CPR(10)
** SET CODE FOR
UPDATE OR POWER, AND
READ AND LIFE
COEFFICIENT
186
07
IPDER = 1
.13.89.
... 50
190
10.15
08
Q =
P1(I)*0.448200
ALF =
P10(I)*0.304800
ALT0 =
P11(I)*0.304800
ALT2E =
P12(I)*0.304800
09
T =
P6(I)*0.3048000
AE =
P13(I)*0.304800
SEE =
P5(I)
*32.1600*16.0200
10
Z =
5.080/9.0900*(P7
(I) - 491.7200) *
273.1800
DV =
P8(I)*0.304800
F =
PSEA(I)
*1.3558800/1000.
000
11
WRITE TO DEV
JWRITE
VIA FORMAT
191
FROM THE LIST
NOTE 12
LIST = H, ALF,
P2(I), ALT0,
P3(I), ALT2E, T,
AE, Z, SEE,
P10(I), P6(I),
CL(I), T, CD(I),
DV, F, P9(I),
PT(I)
** PUNCH CARDS
10.17
192
13
IPUNCH .EQ. 0
TRUE
FALSE . 38 .
. 21 .
197
14
TRUE
I .EQ. 1
FALSE
15
WRITE TO DEV
JPUNCH
VIA FORMAT
193
FROM THE LIST
NOTE 16
LIST =
(TITLE(J),J =
1,20)
17
WRITE TO DEV
JPUNCH
VIA FORMAT
194
FROM THE LIST
NOTE 18
LIST = K, S, RHO,
T7, SE1, SE2,
SE3, SE4, IER1,
IER2, IER3, IER4,
(CPR(J),J = 1,14)
195
19
WRITE TO DEV
JPUNCH
VIA FORMAT
196
FROM THE LIST
NOTE 20
LIST = PINE(I),
P1(I), P2(I),
P3(I), P4(I),
P5(I), P6(I),
P7(I), P8(I),
P9(I), P10(I),
P11(I), P12(I),
P13(I), P14(I),
CL(I), CD(I),
PSEA(I)
38.13
197
21
END OF DO
LOOP
TRUE
20
16
15
/35.01

CHART TITLE - PROGRAM



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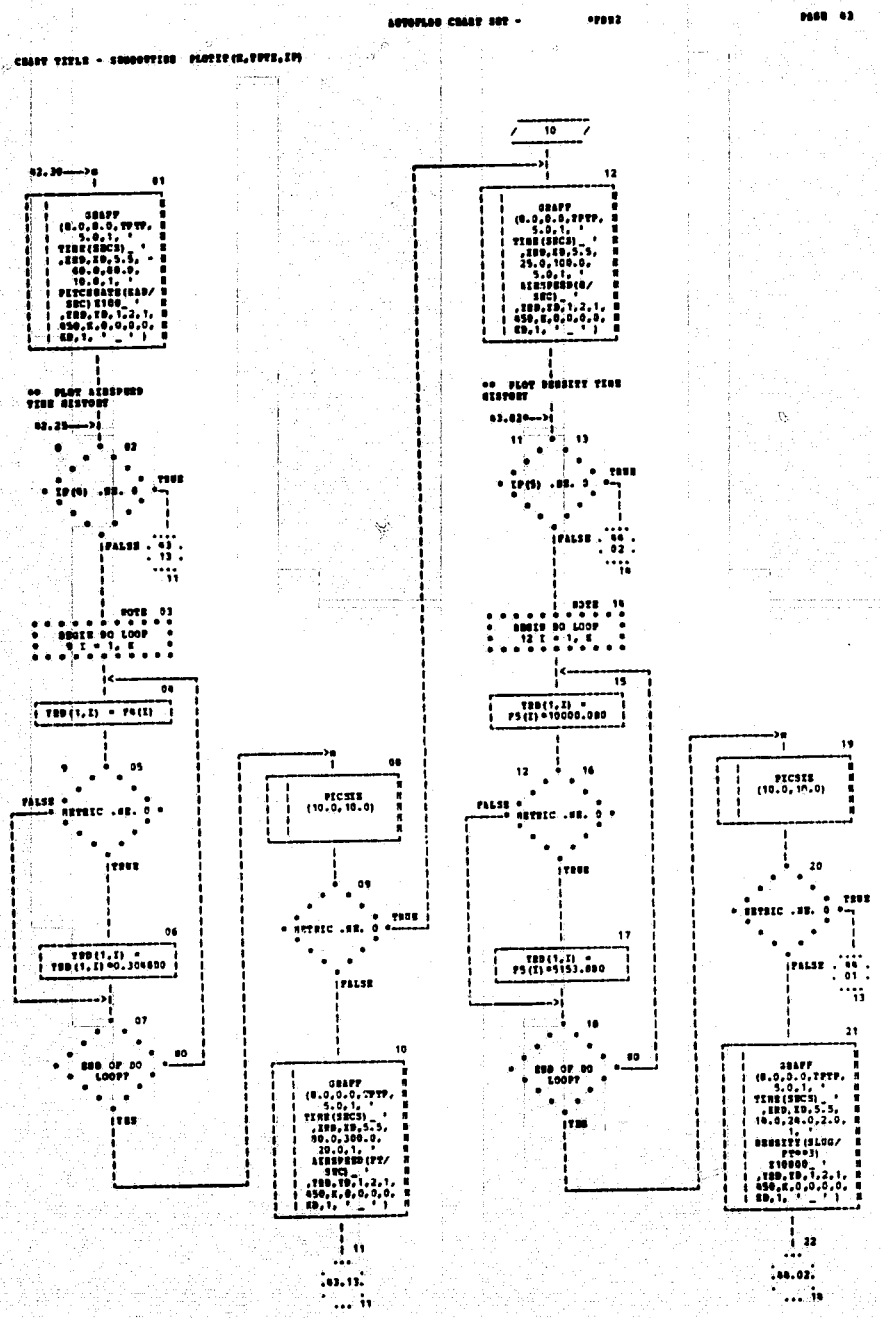
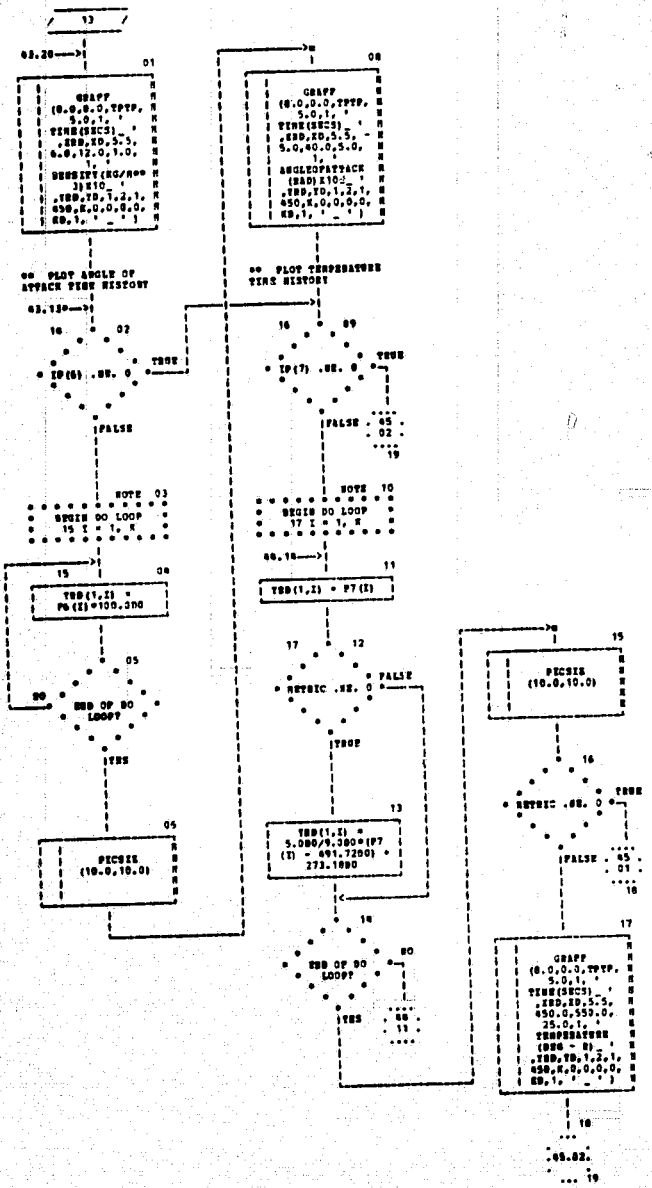


CHART TITLE - SUBROUTINE PLOTIT(N,TPTS,IP)



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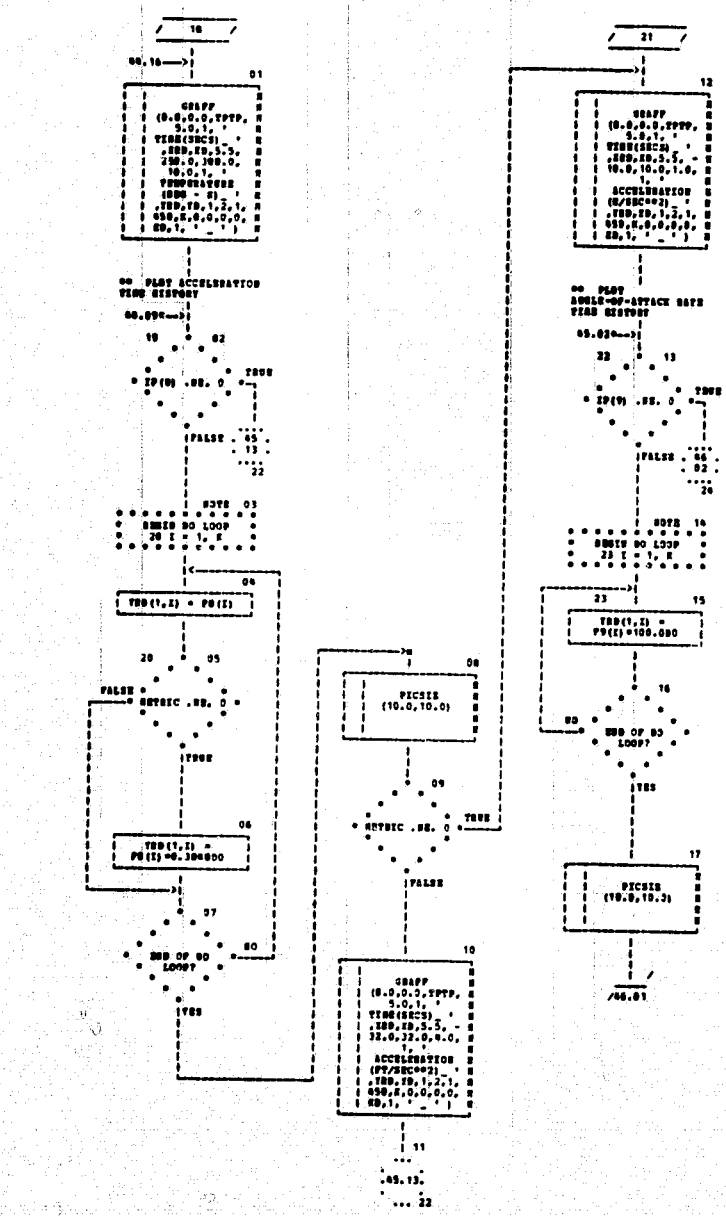
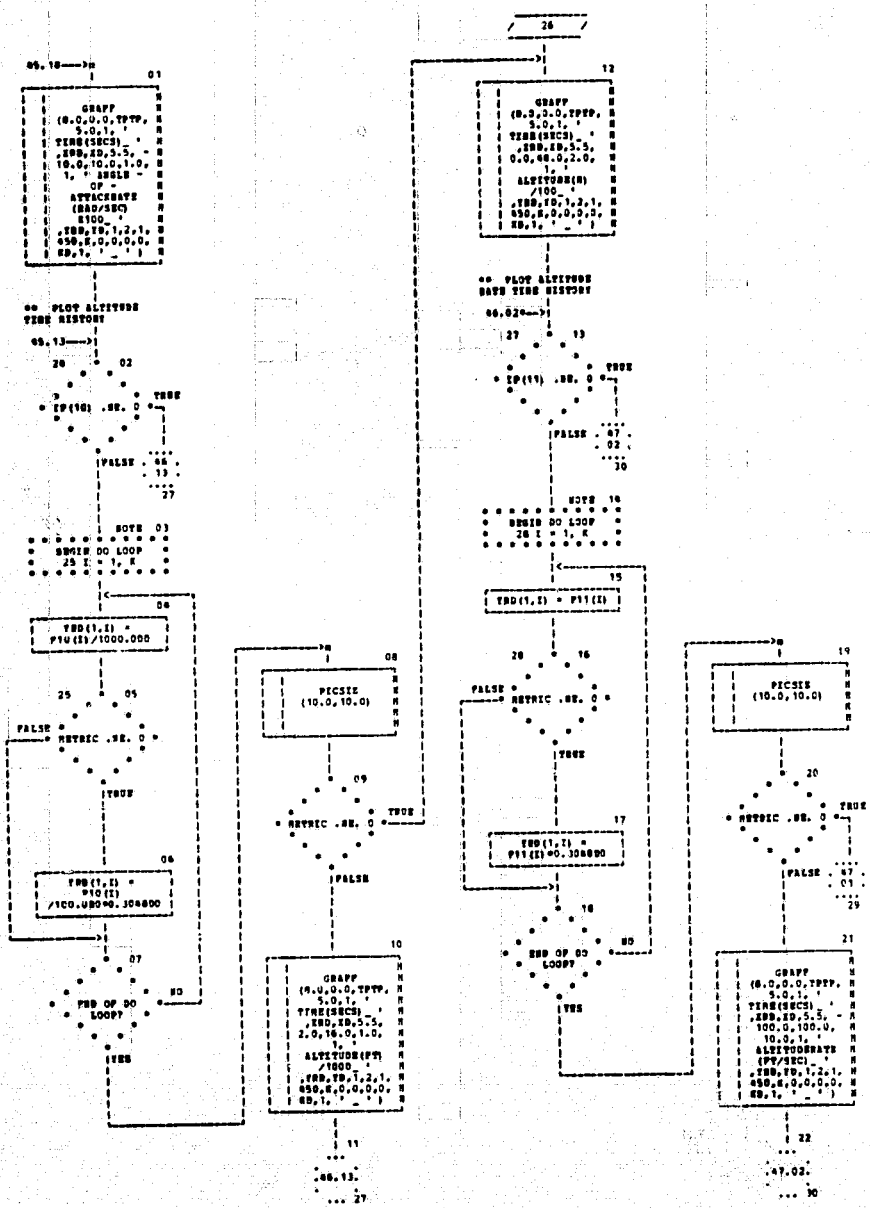


CHART TITLE - SUBROUTINE PLOTIT(N,TPTS,IP)



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CHART TITLE - SUBROUTINE PLOTIT(N,TTTT,IF)

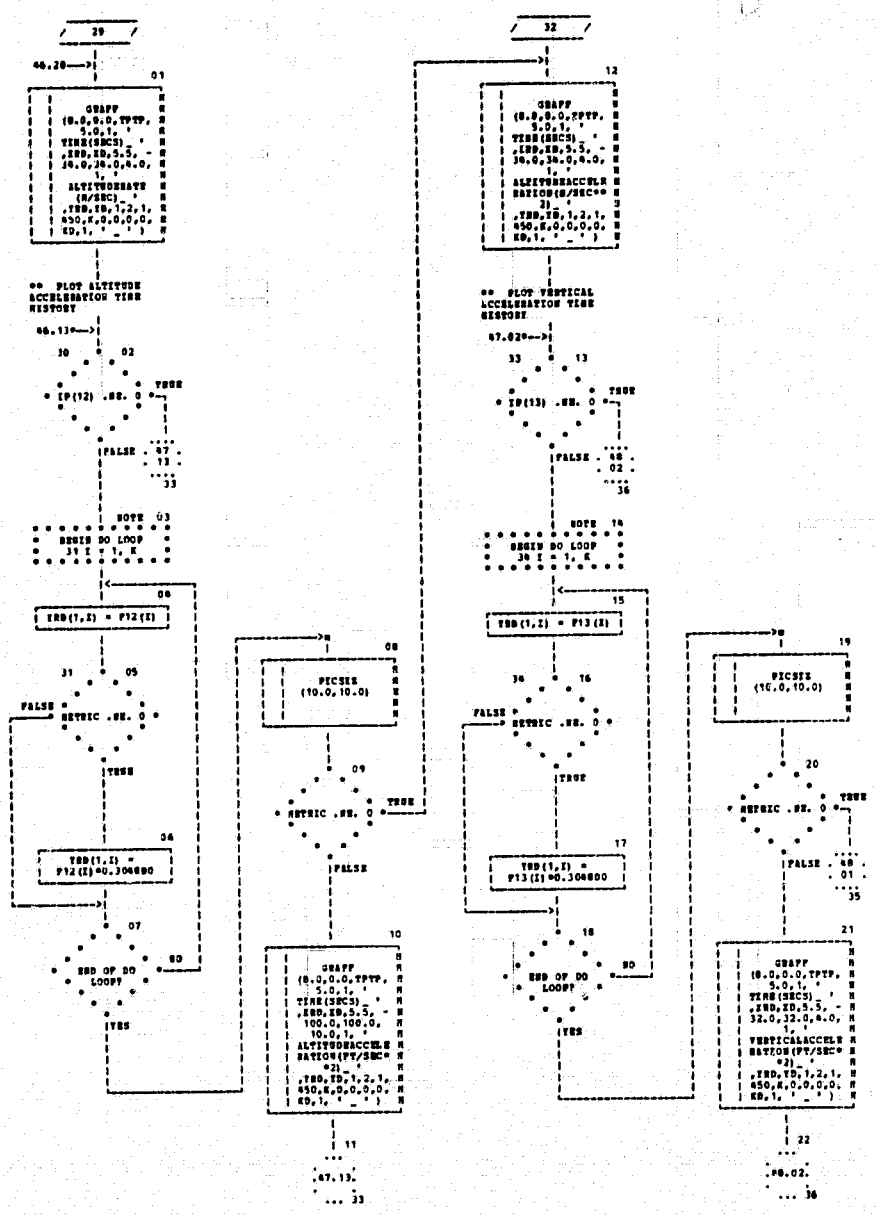
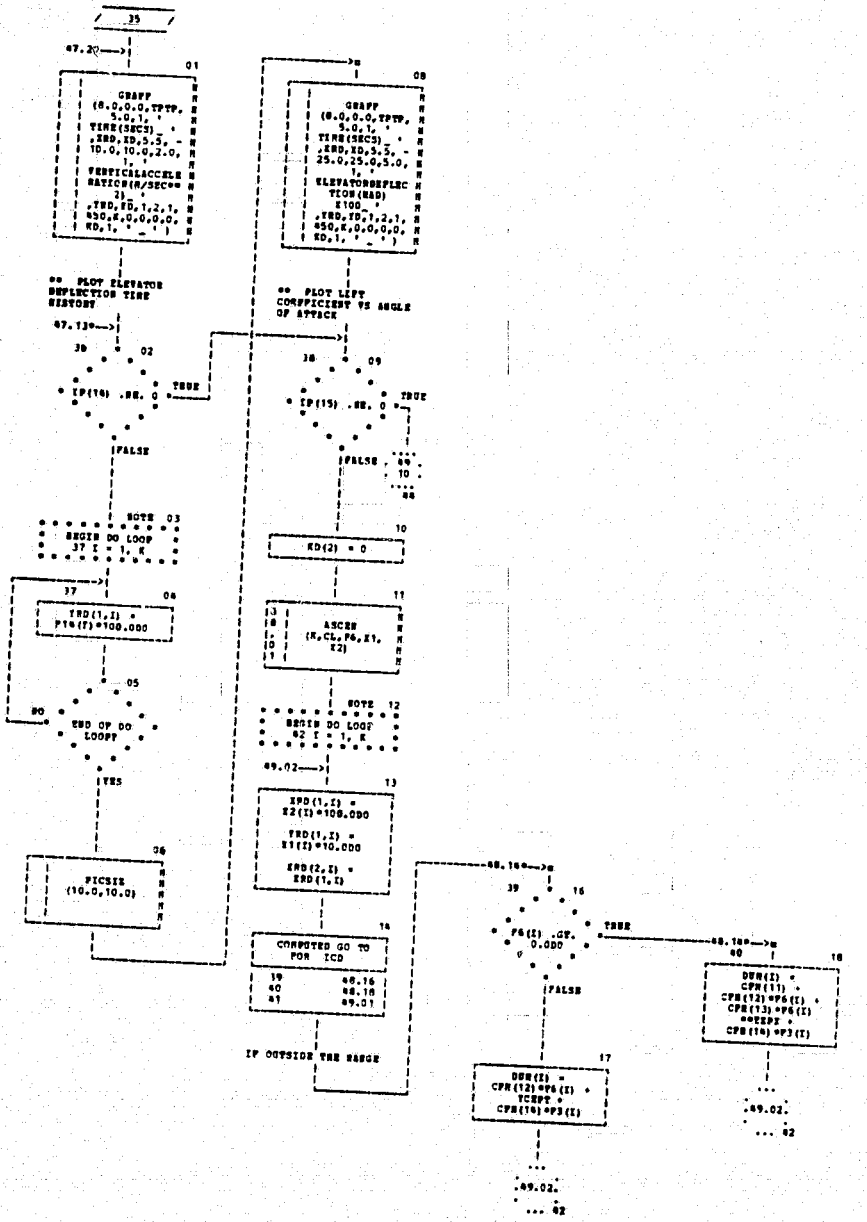


CHART TITLE - SUBROUTINE PLOTIF(K,TYPE,IP)



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CHART TITLE - SUBROUTINE PLOTIP(N,TYPE,IP)

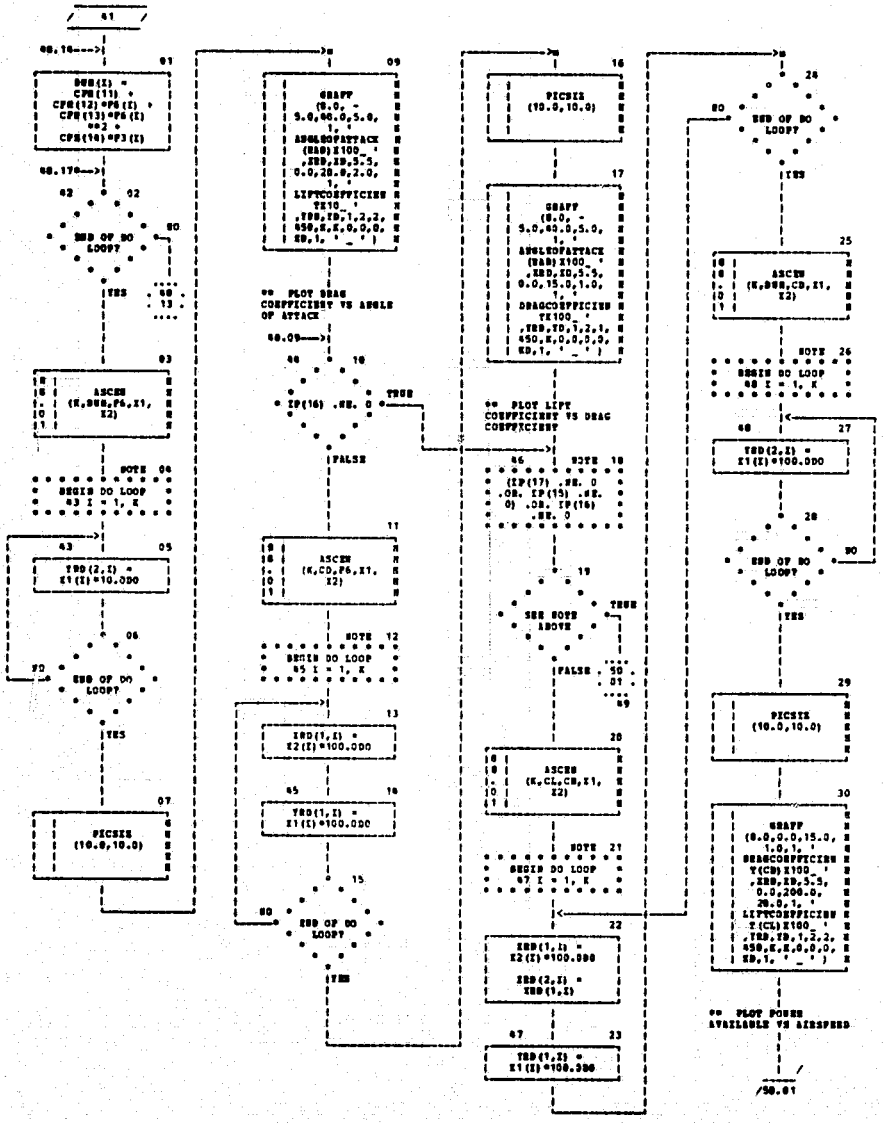
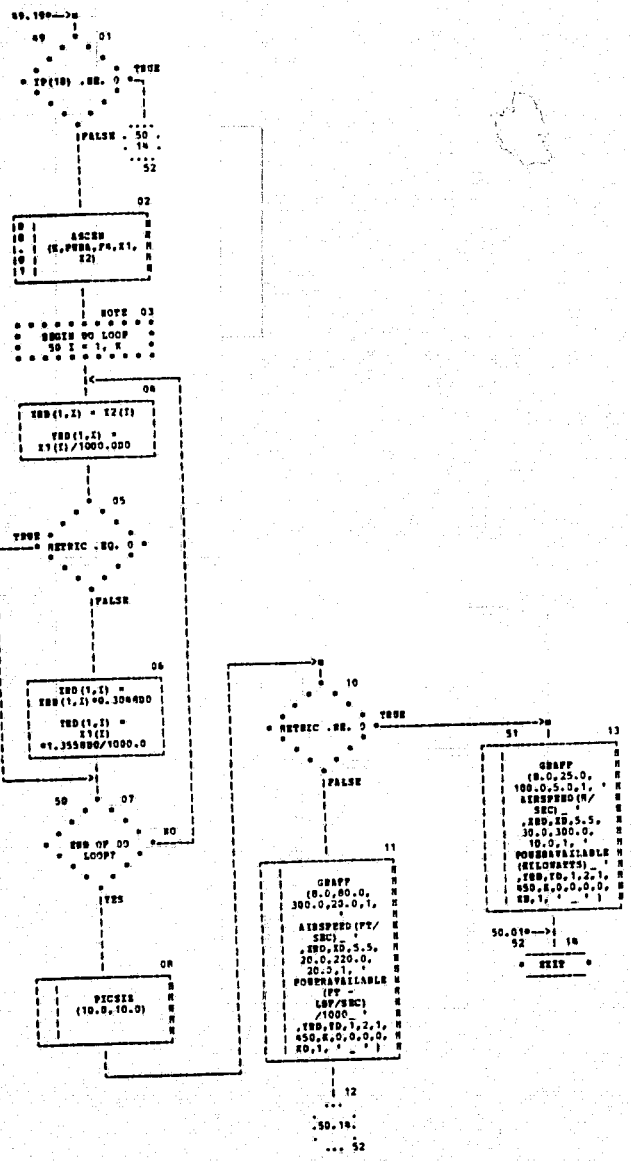
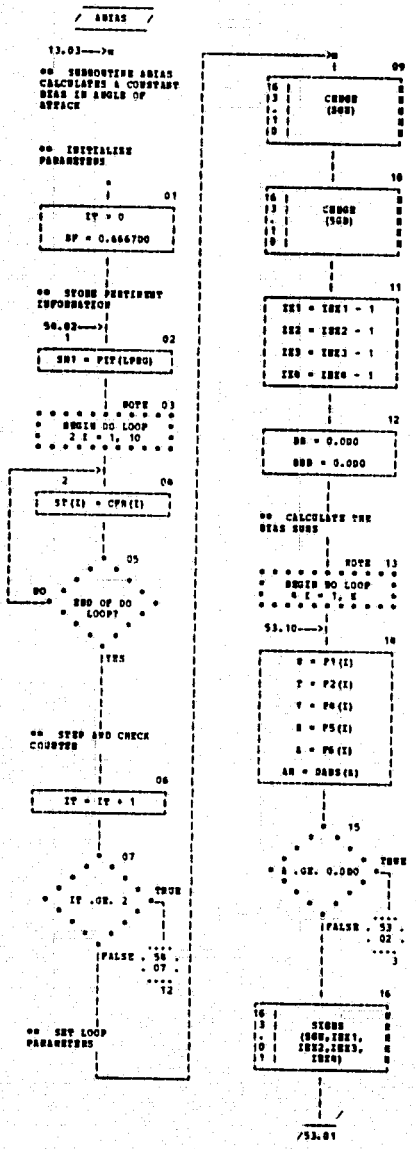


CHART TITLE - SUBROUTINE PLOTIT(N,TPTI,IP)



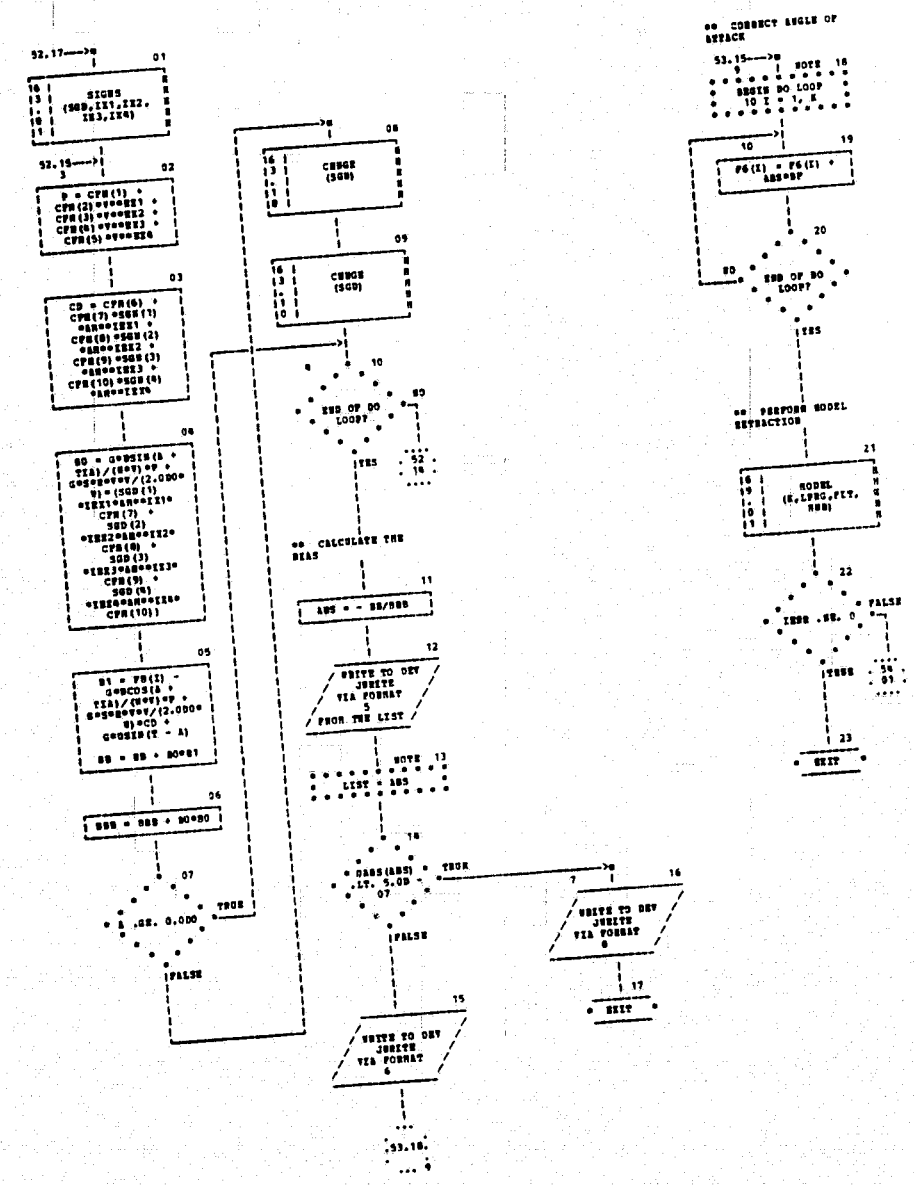
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CHART TITLE - SUBROUTINE ABIAS(K,LPBG,PIT,BBB)



ASTROFLOW CHART SET - *FREE

CHART TITLE - SUBROUTINE ABIAS(E,LPRG,FIT,HHH)



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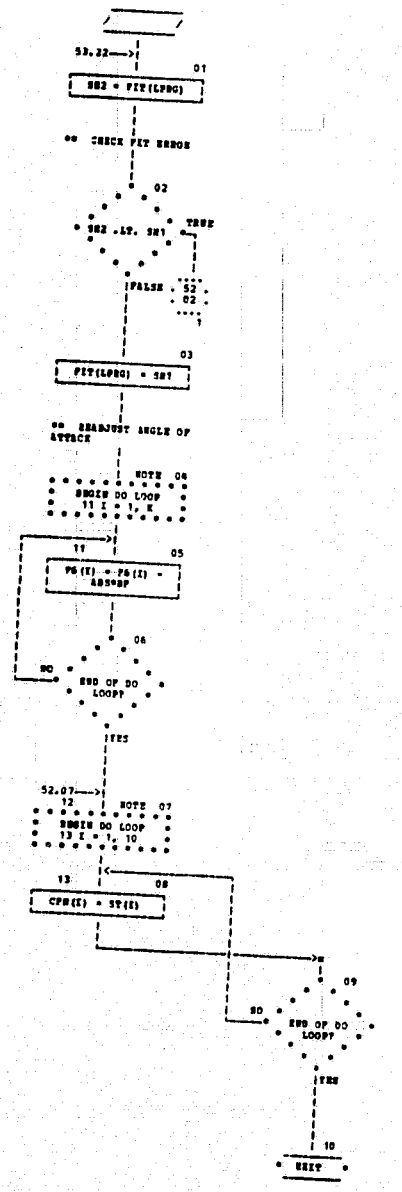
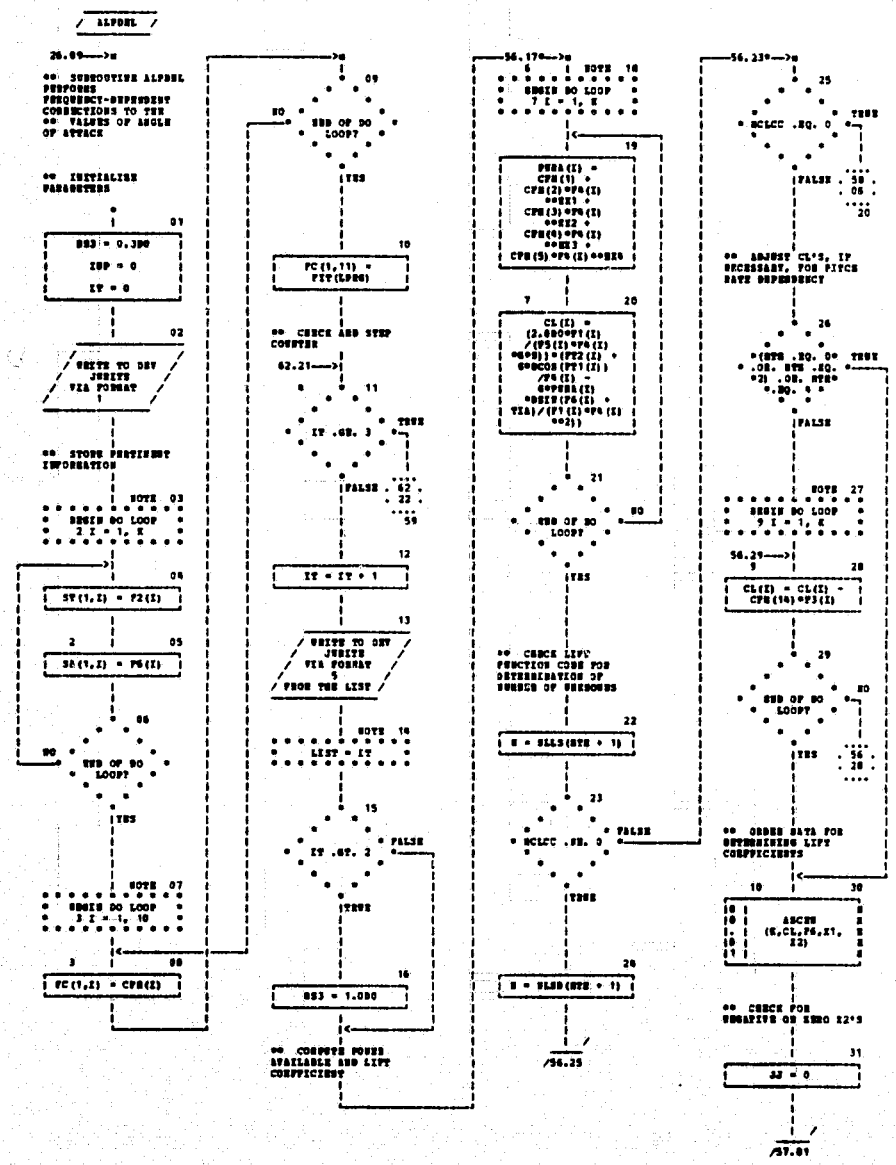


CHART TITLE - SUBROUTINE ALPDBL(K,LPRO,RHO,PIT)



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CHART TITLE - SUBROUTINE ALPHEL(K,LPRO,RMS,FIT)

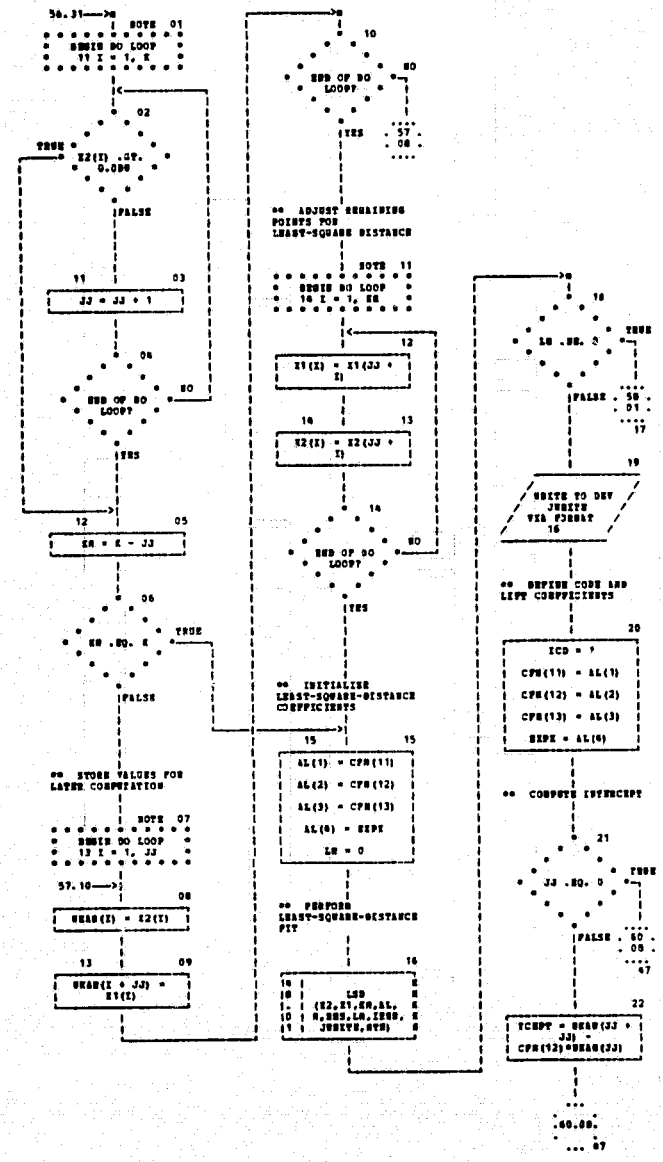
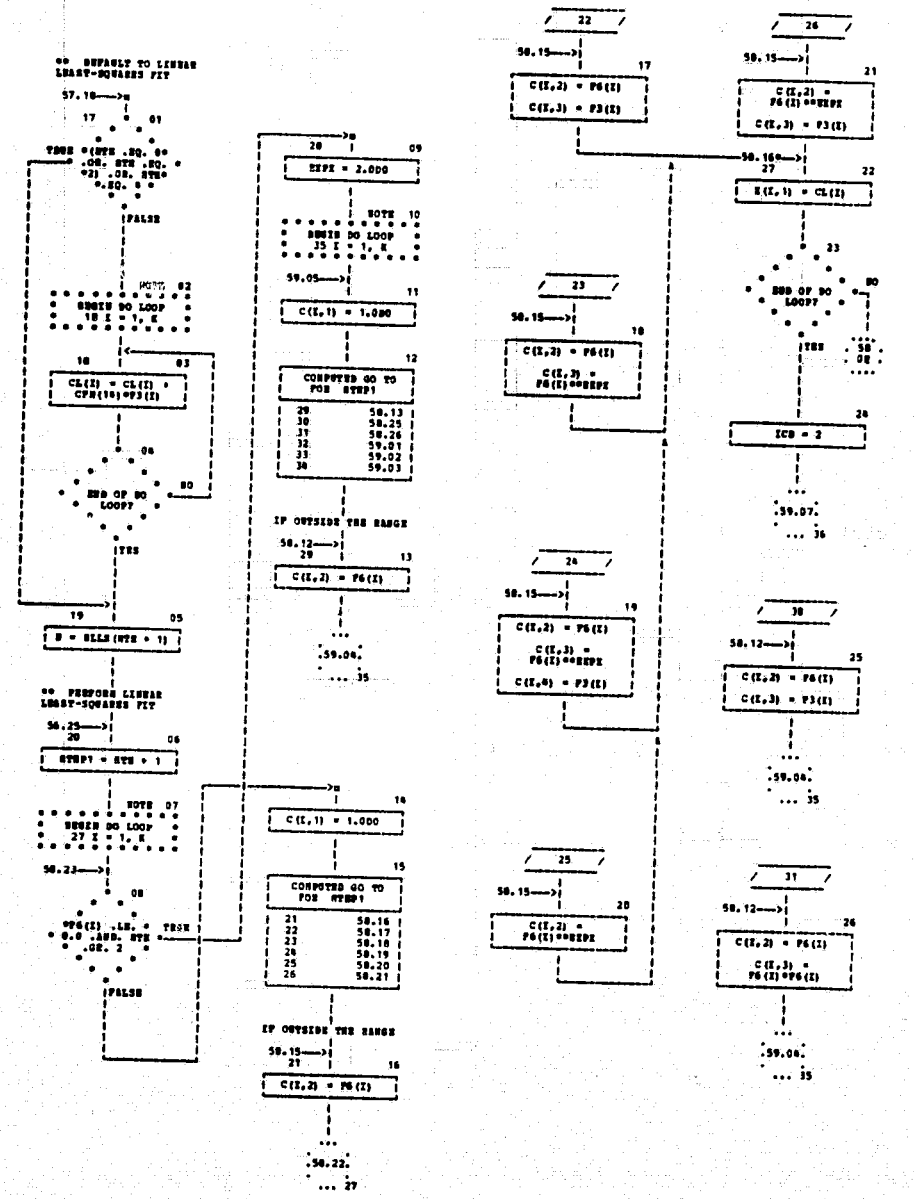


CHART TITLE - SUBROUTINE ALPOLY(K,LPRG,SUB,FIT)



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CHART TITLE - SUBROUTINE SLPOLL(X,LPDB,NDB,FIT)

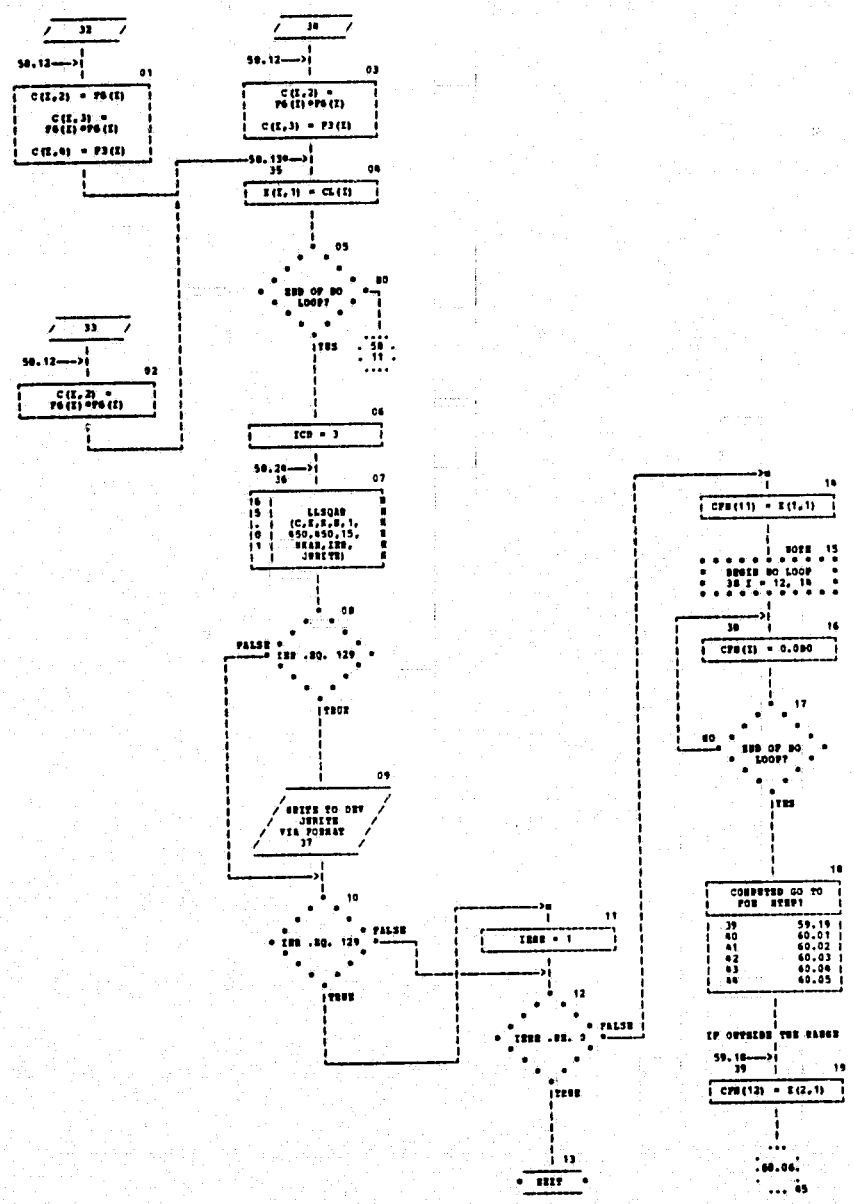
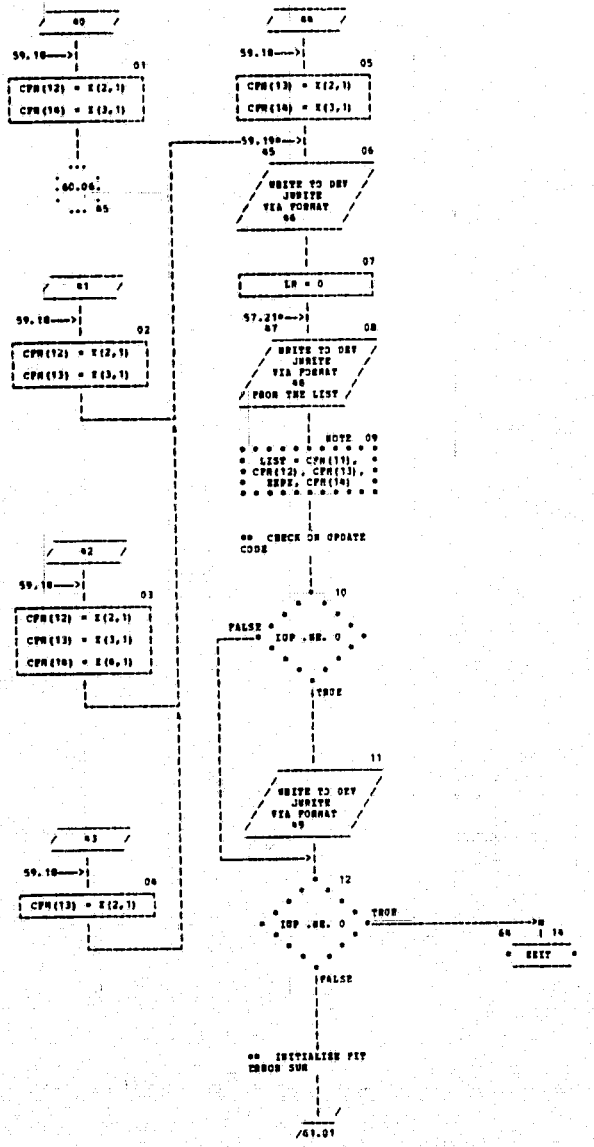


CHART TITLE - SUBROUTINE ALPOSL(K,LPOS,NUM,FIT)



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CHART TITLE - SUBROUTINE ALPSEL(K,LPSW,RES,FIT)

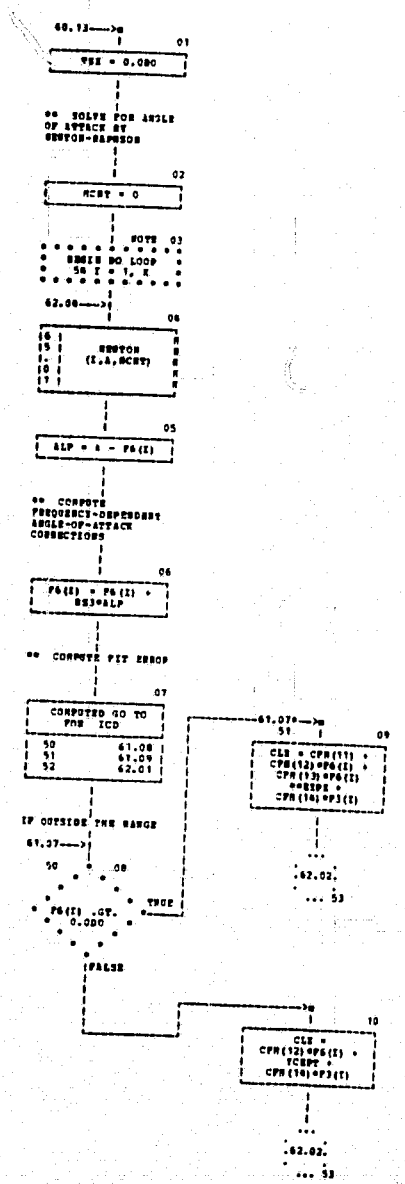
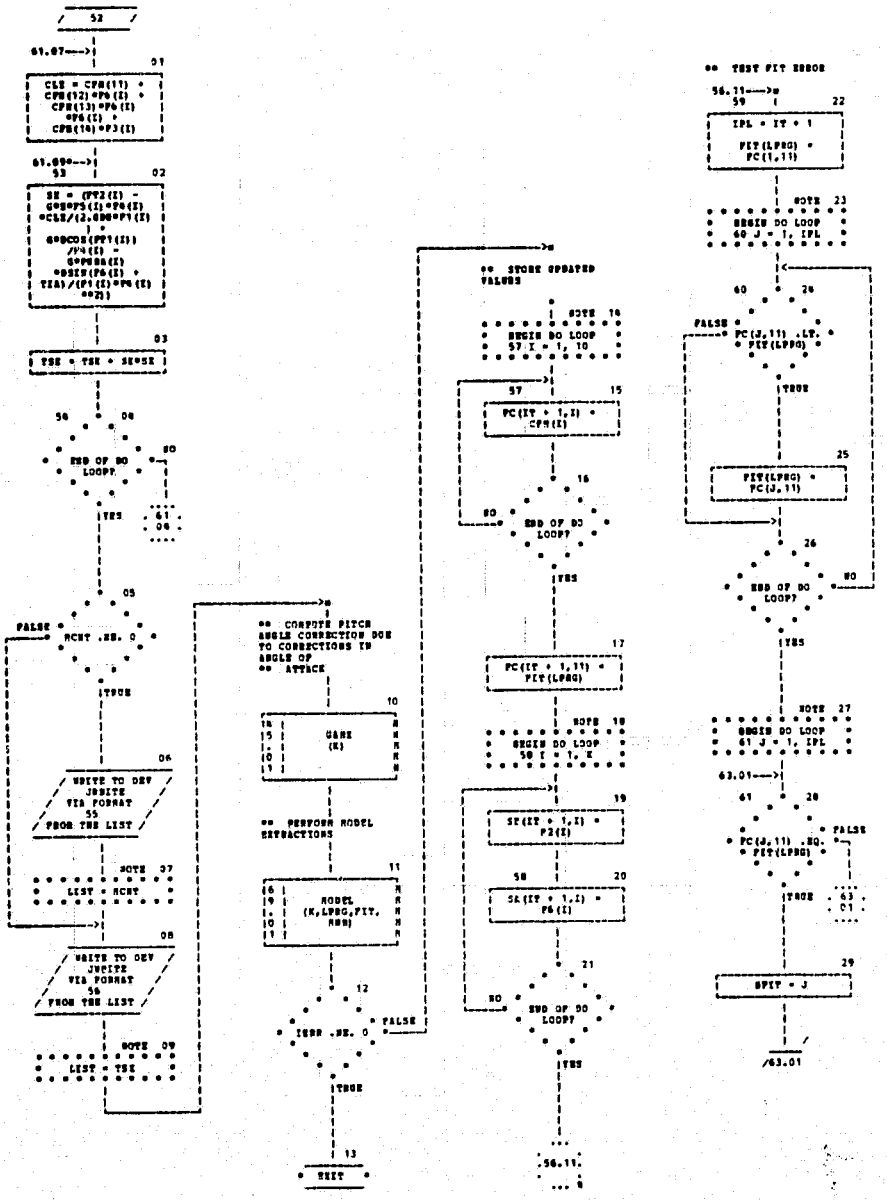


CHART TITLE - SUBROUTINE ALPOBL(K,LPBG,RHO,FIT)



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CHART TITLE - SUBROUTINE ALPDEL(E,LPOS,SPD,FIT)

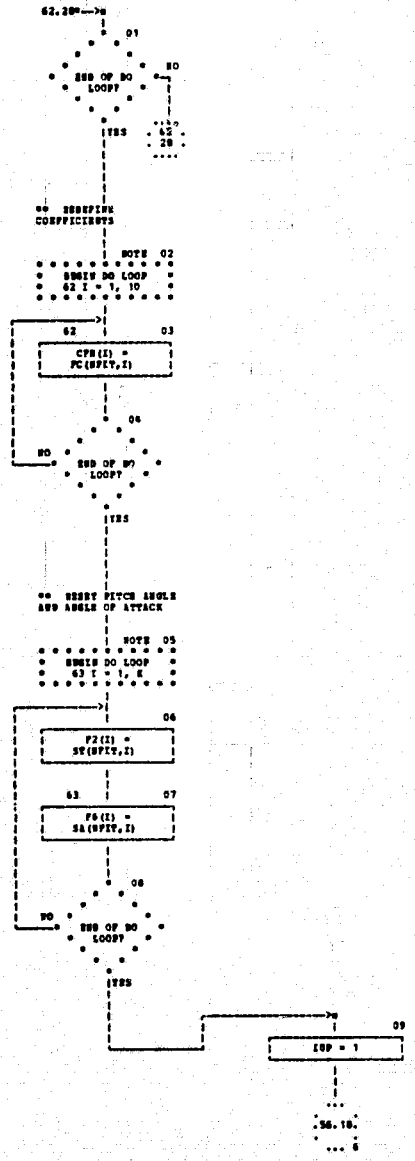
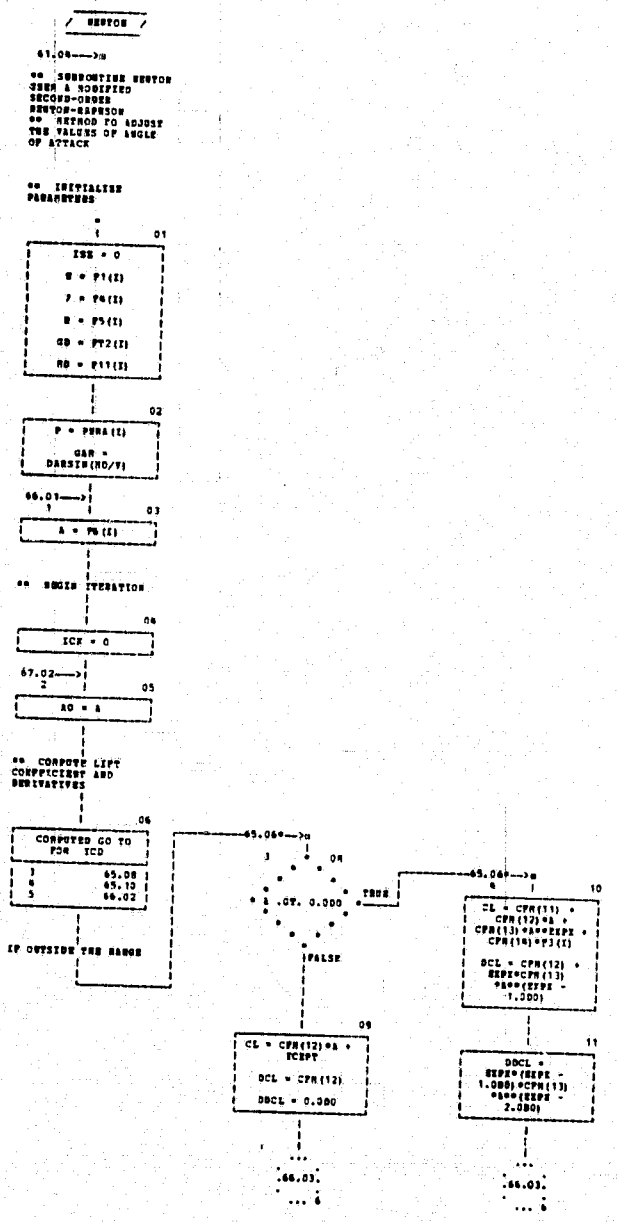


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CHART TITLE - SUBROUTINE SUBPROG(I,ALP,RCNT)

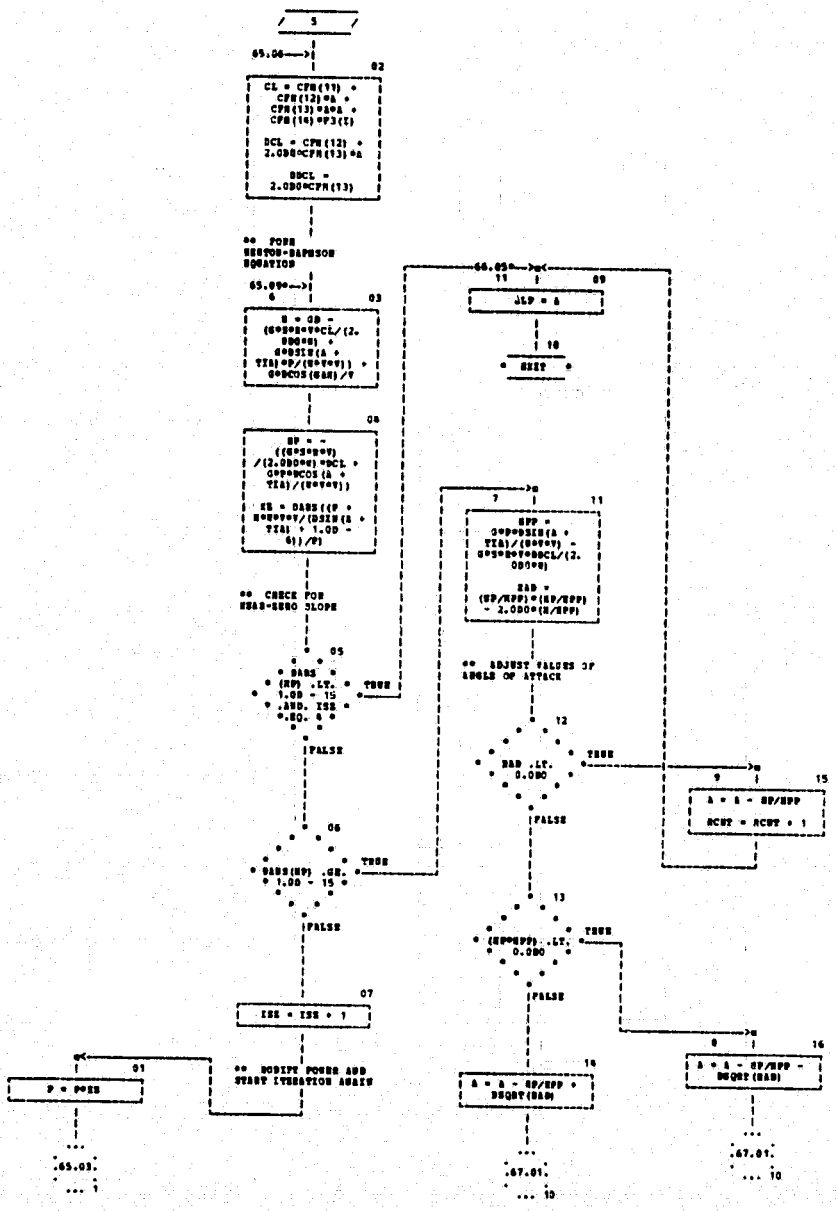
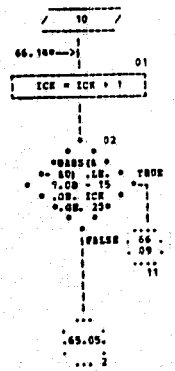


CHART TITLE - SUBROUTINE SEUTOU(I,ALP,ACUT)



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CHART TITLE - SUBROUTINE MODEL(K,LPRG,PIT,ERR)

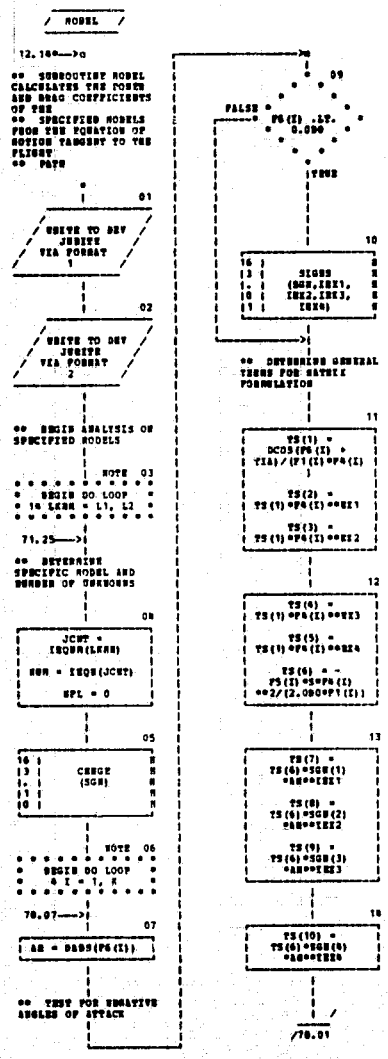
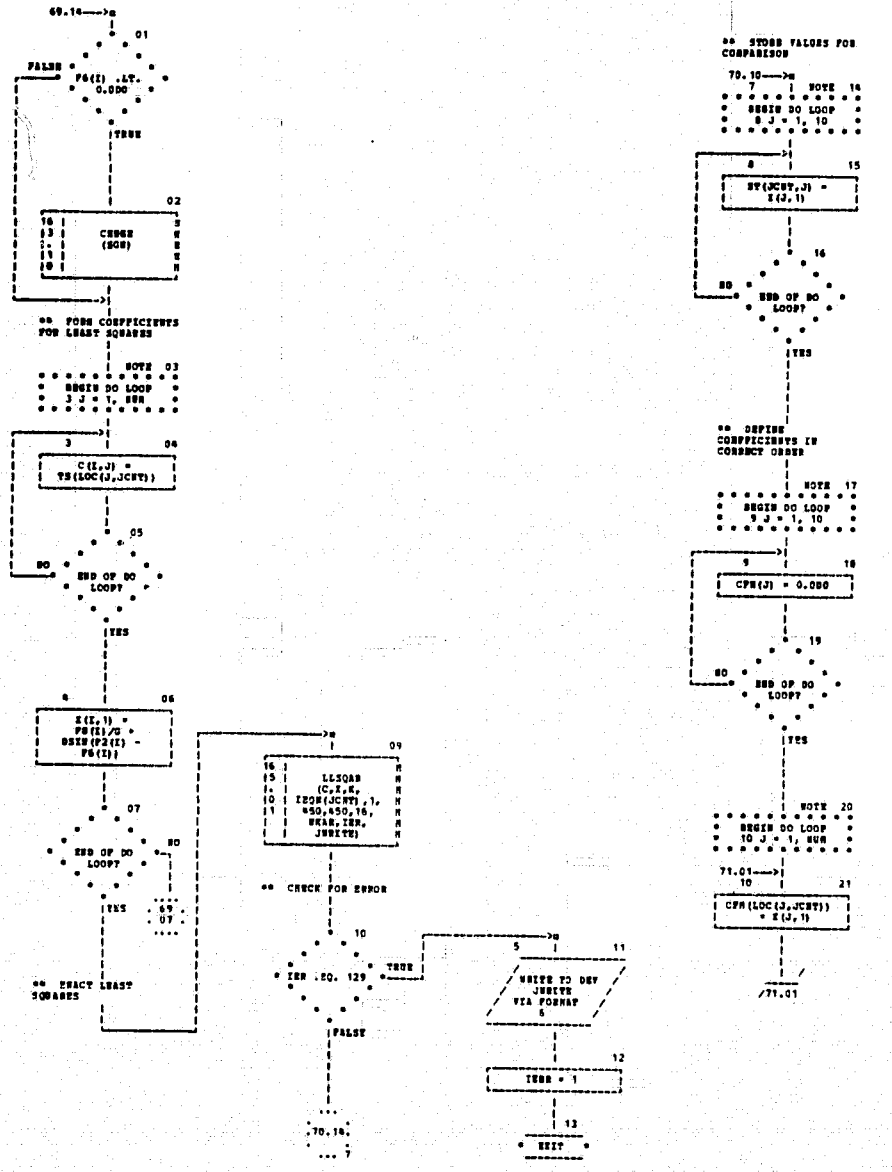


CHART TITLE - SUBROUTINE SUBEL(E,LPRG,FIT,SUM)



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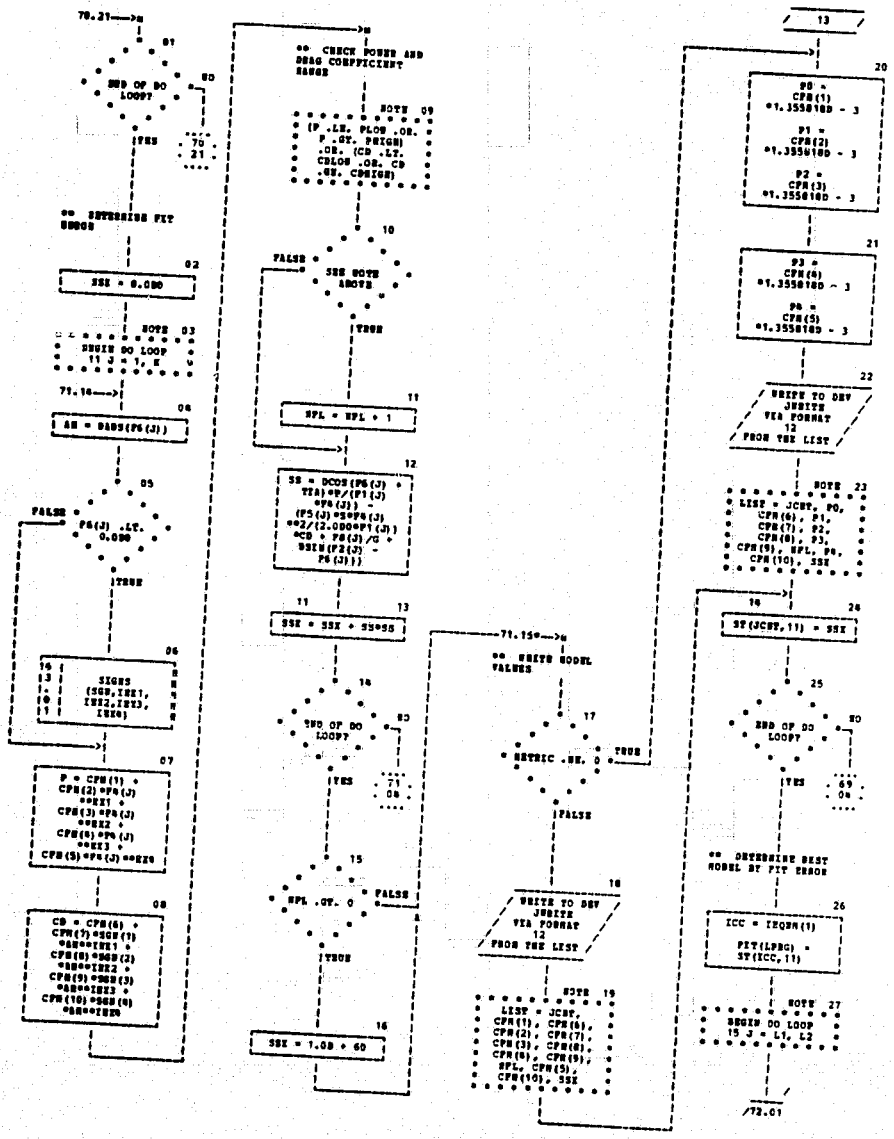
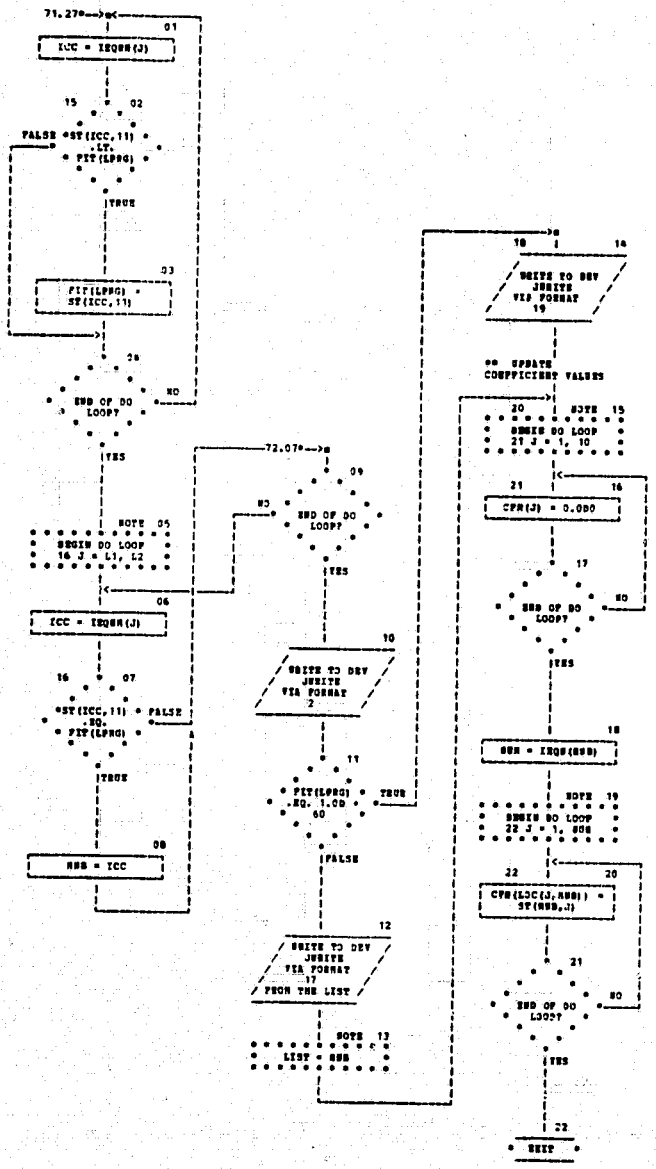


CHART TITLE - SUBROUTINE MODEL(N,LPRG,FIT,NRB)



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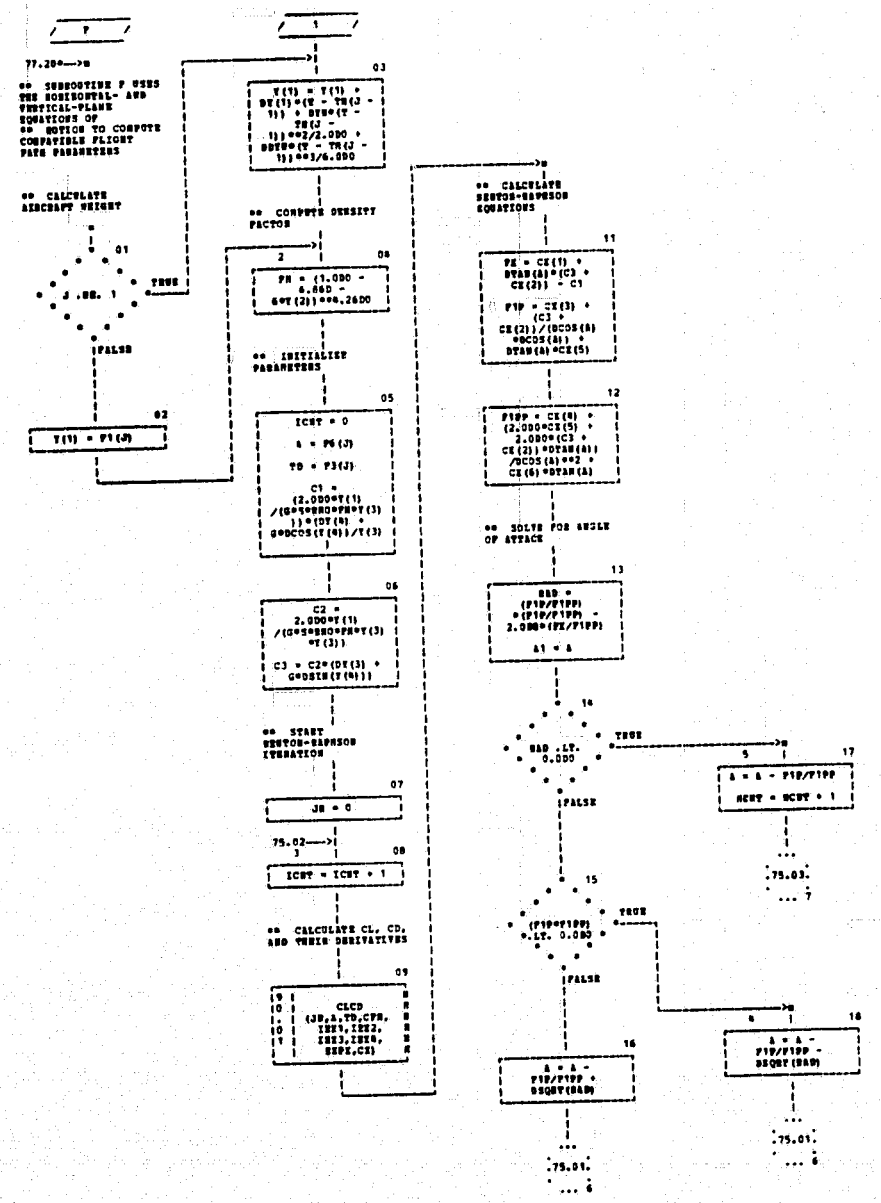
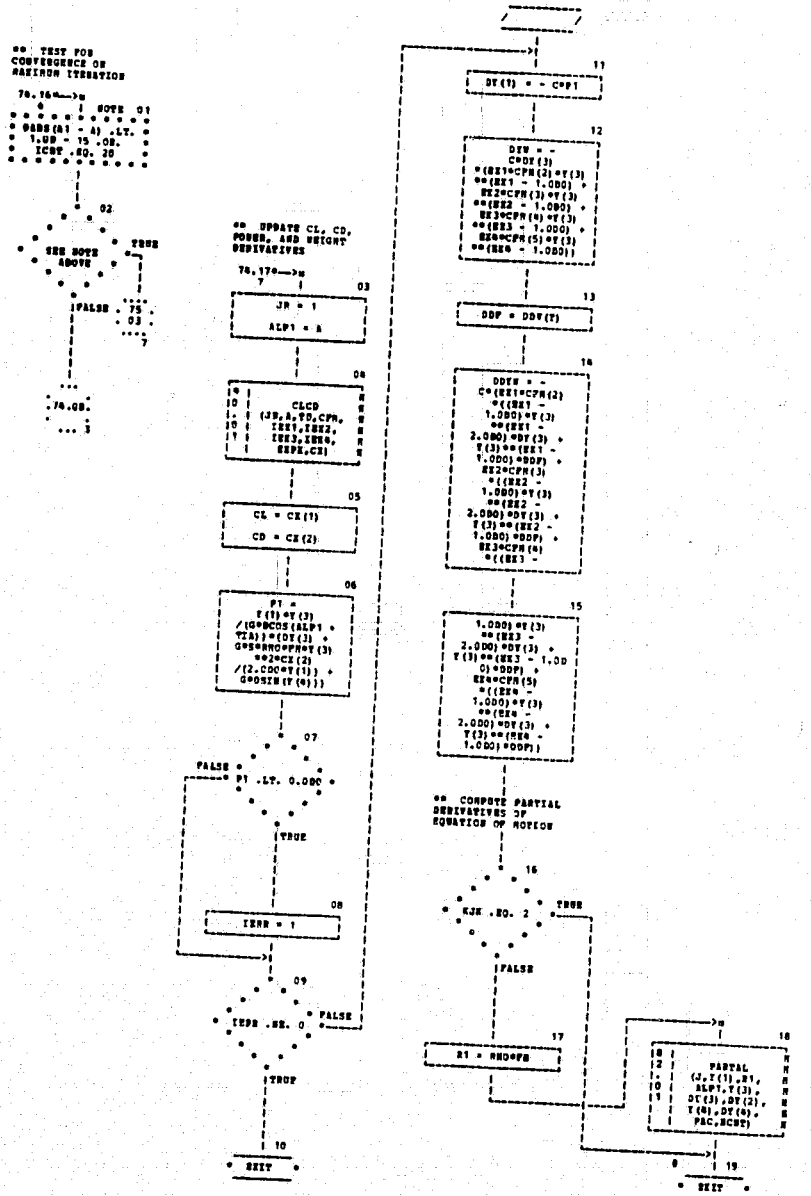


CHART TITLE - SUBROUTINE F(Z,Y,DY,C,KJK,J,IPATH,RCNT,ECNT)



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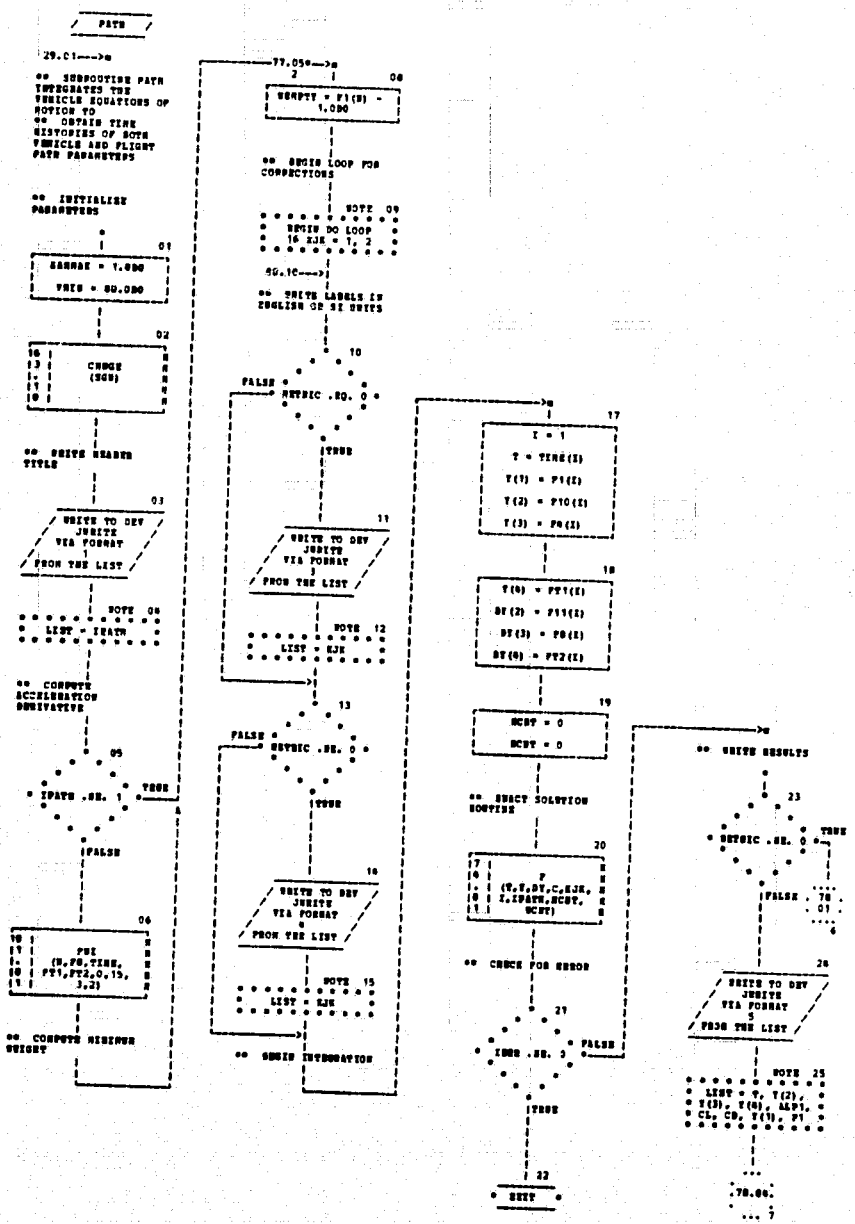
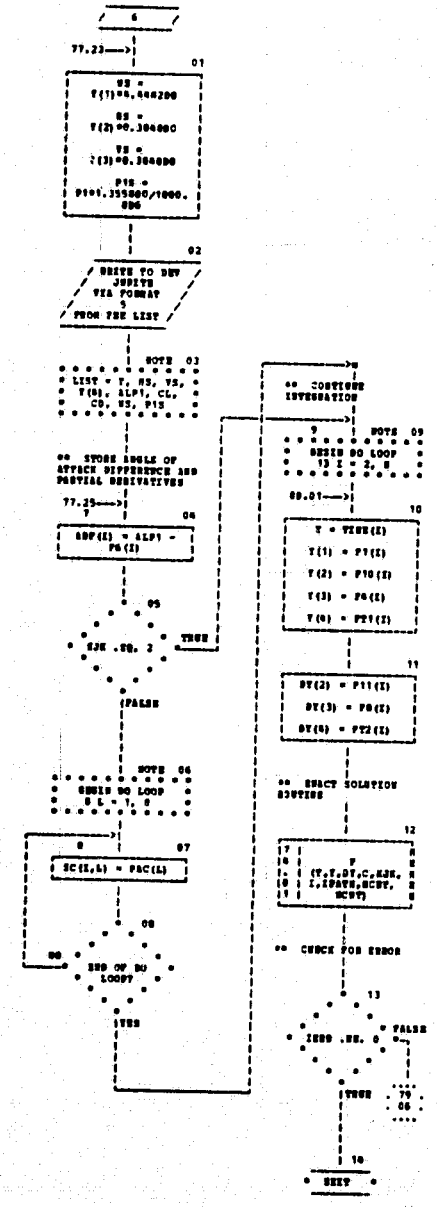


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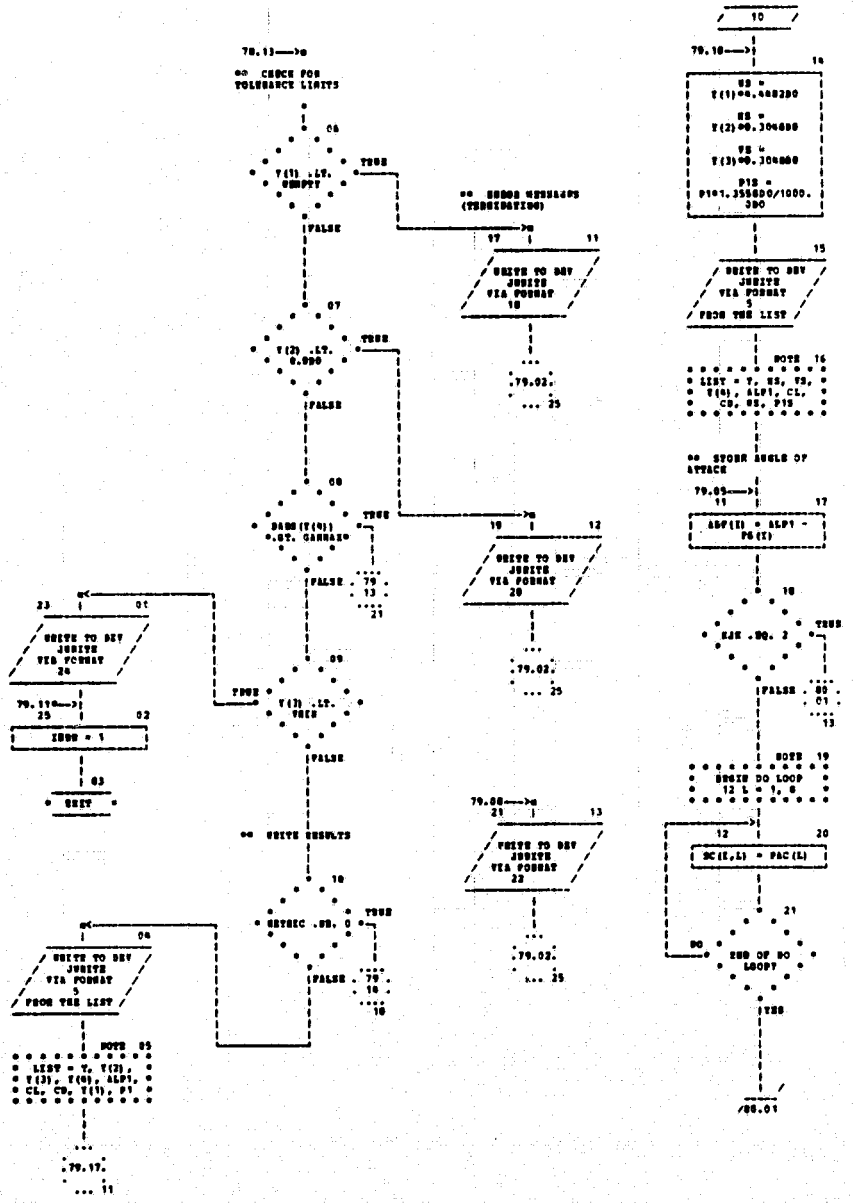


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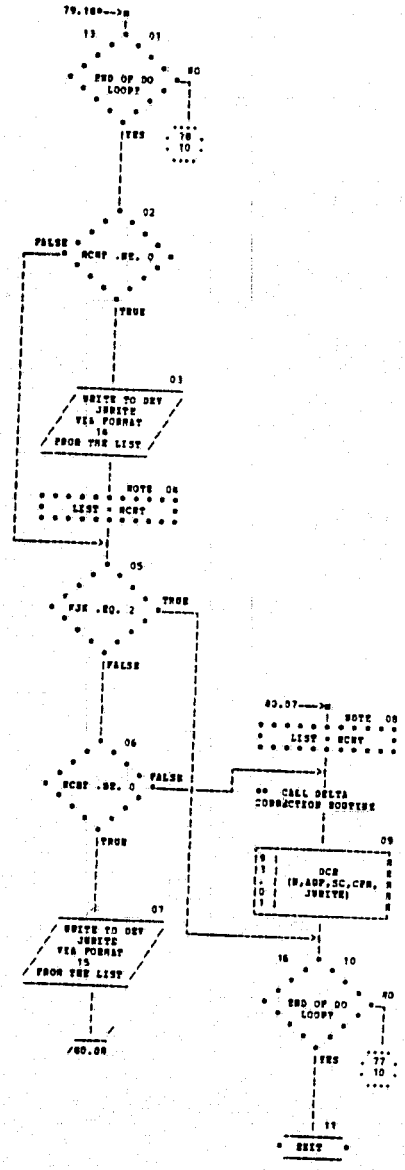
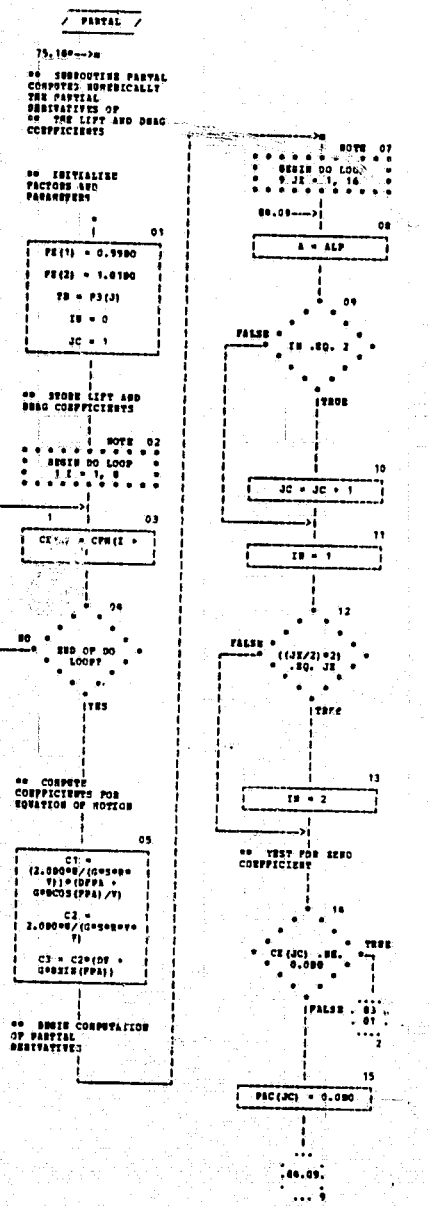


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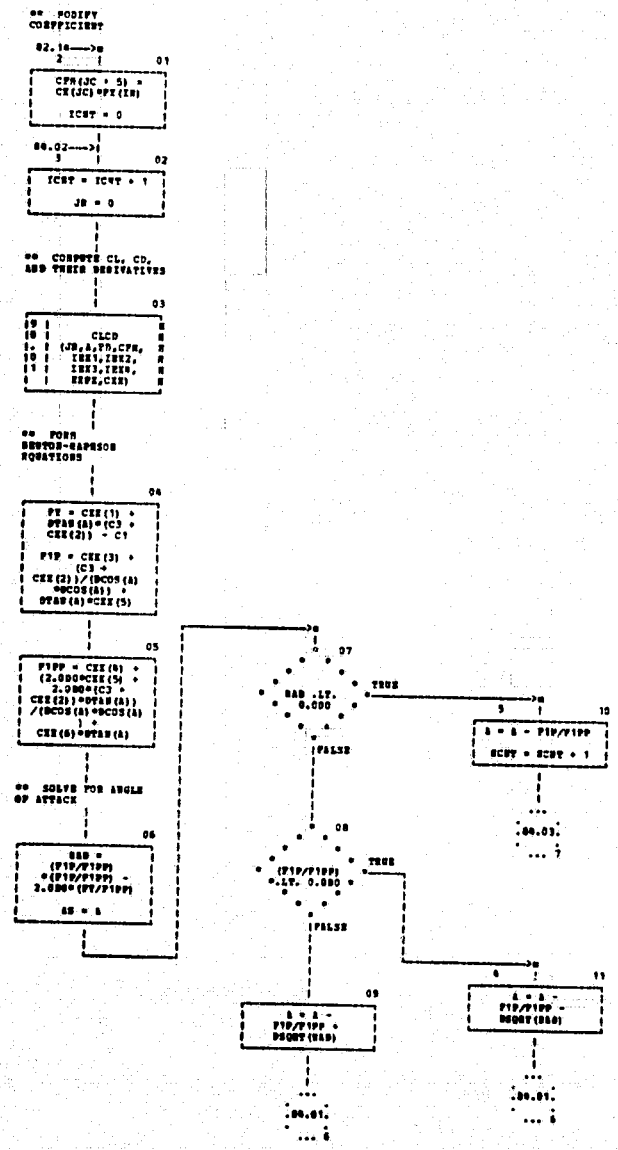


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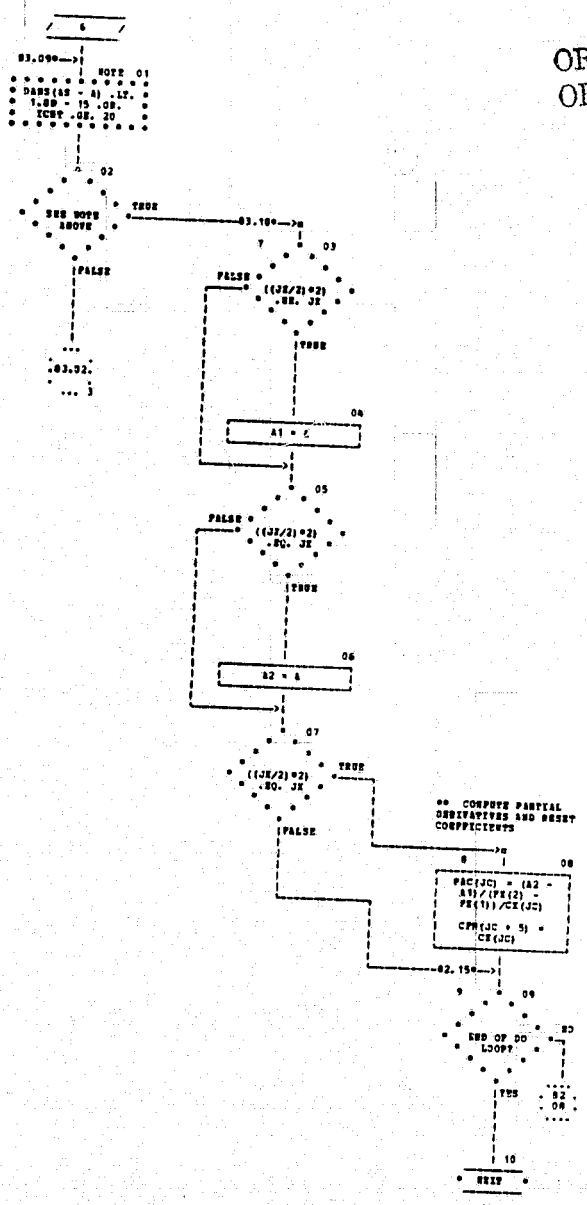


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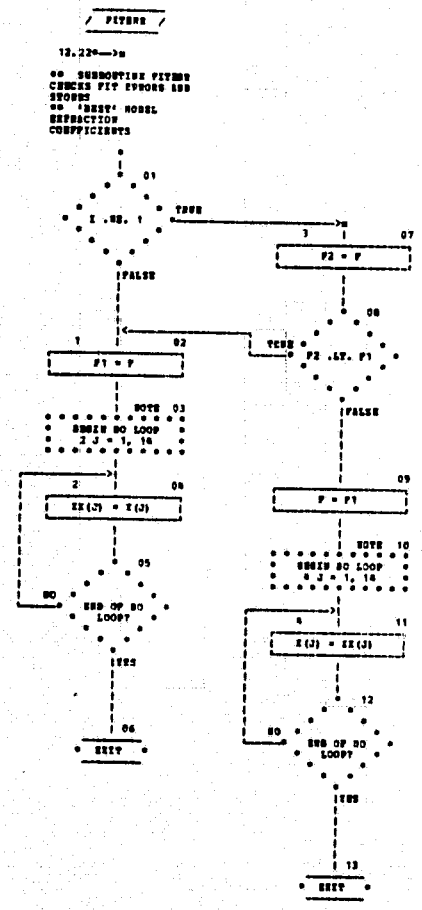
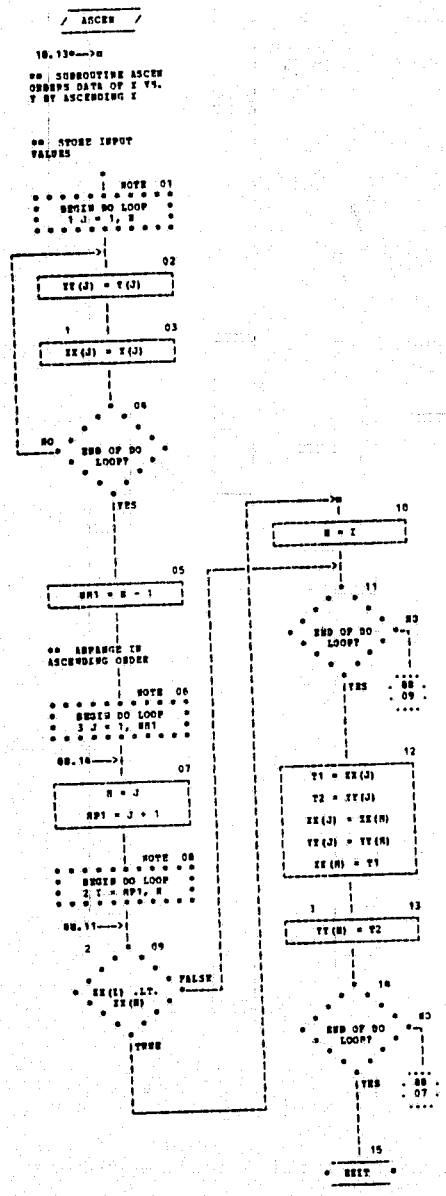
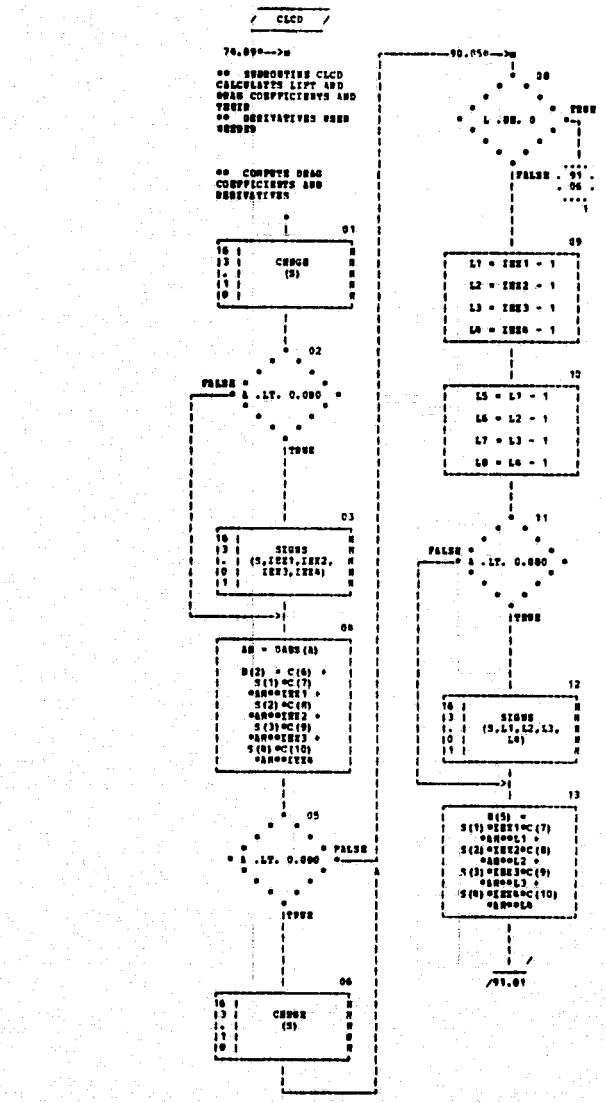


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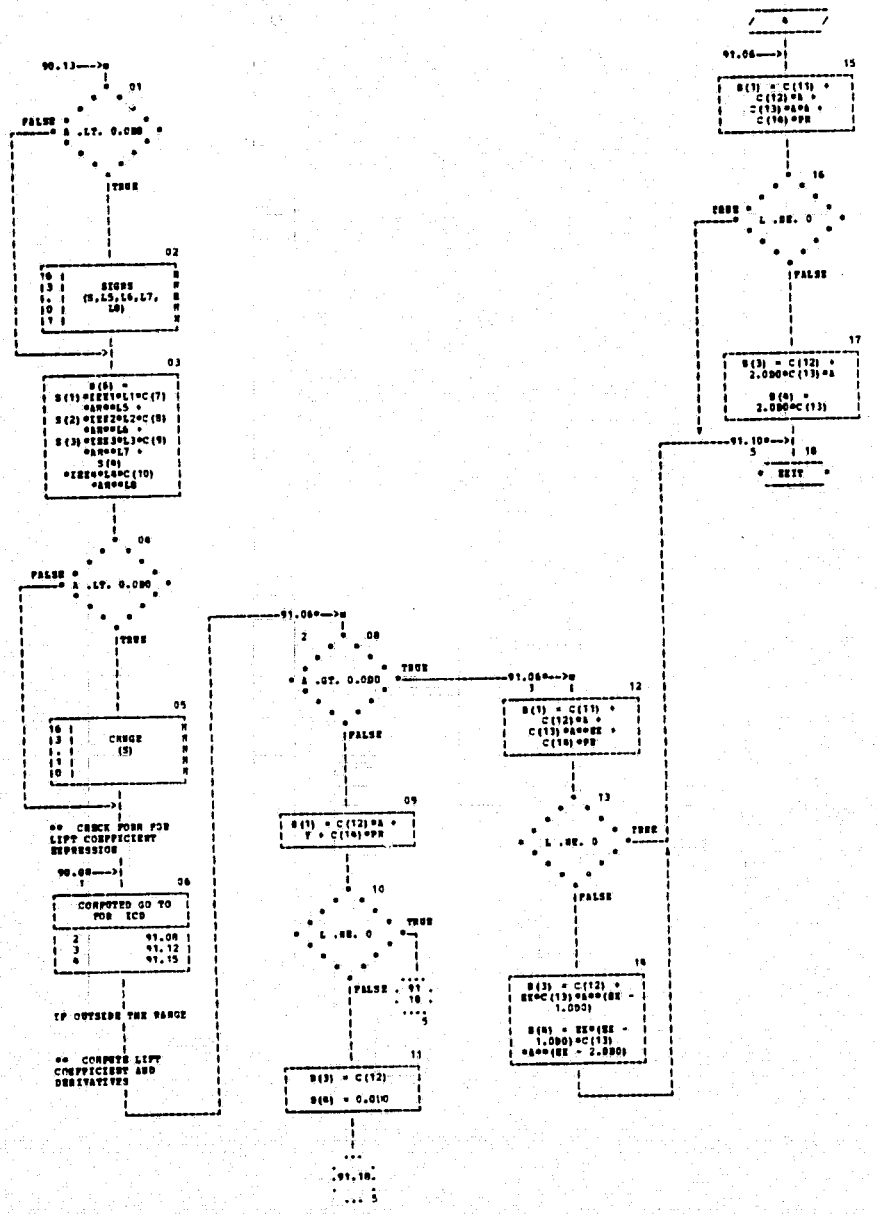
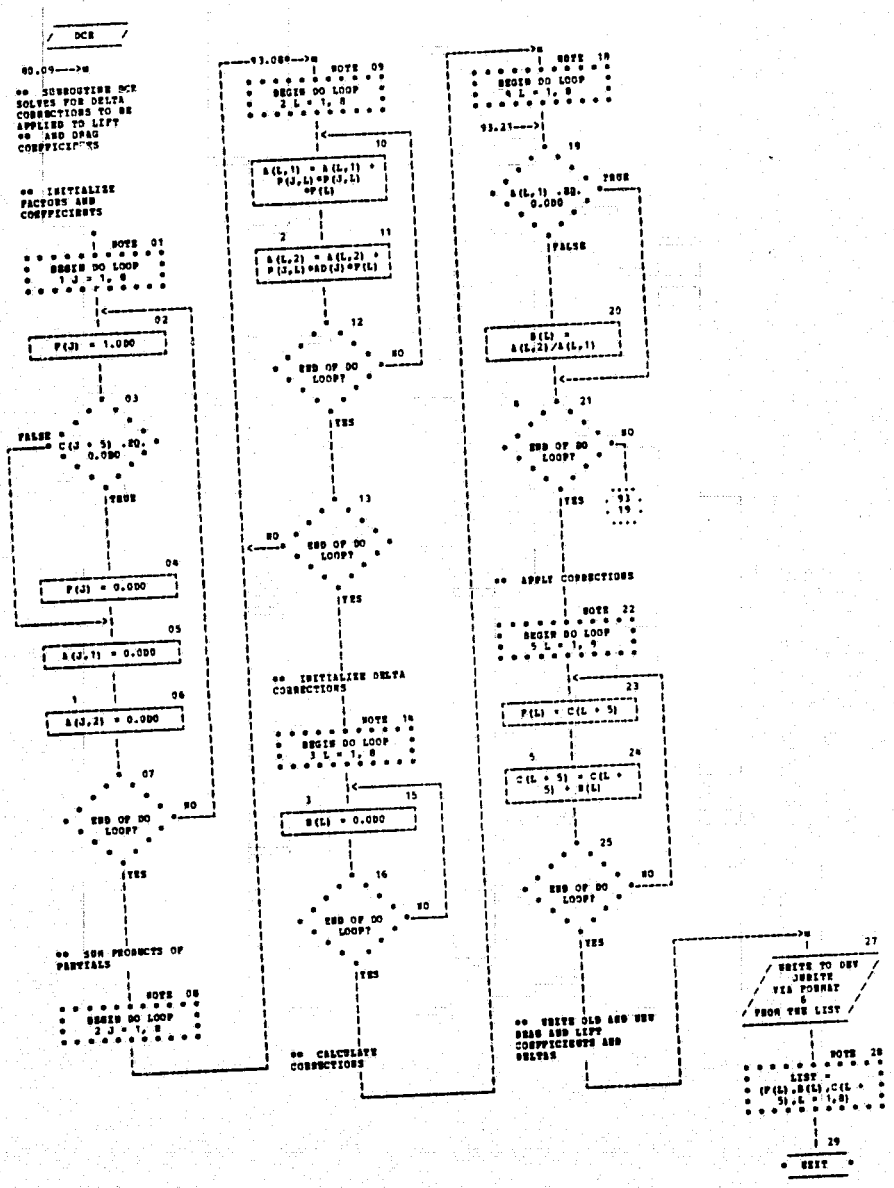


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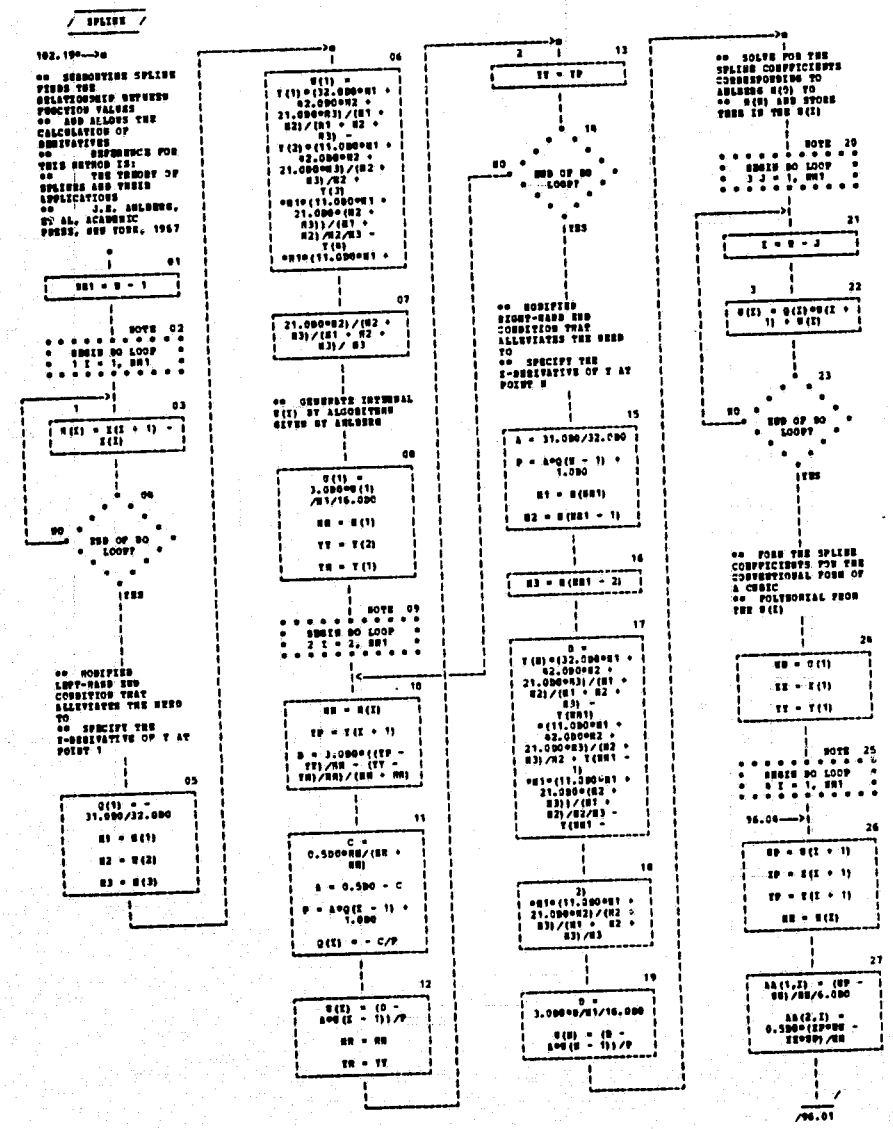
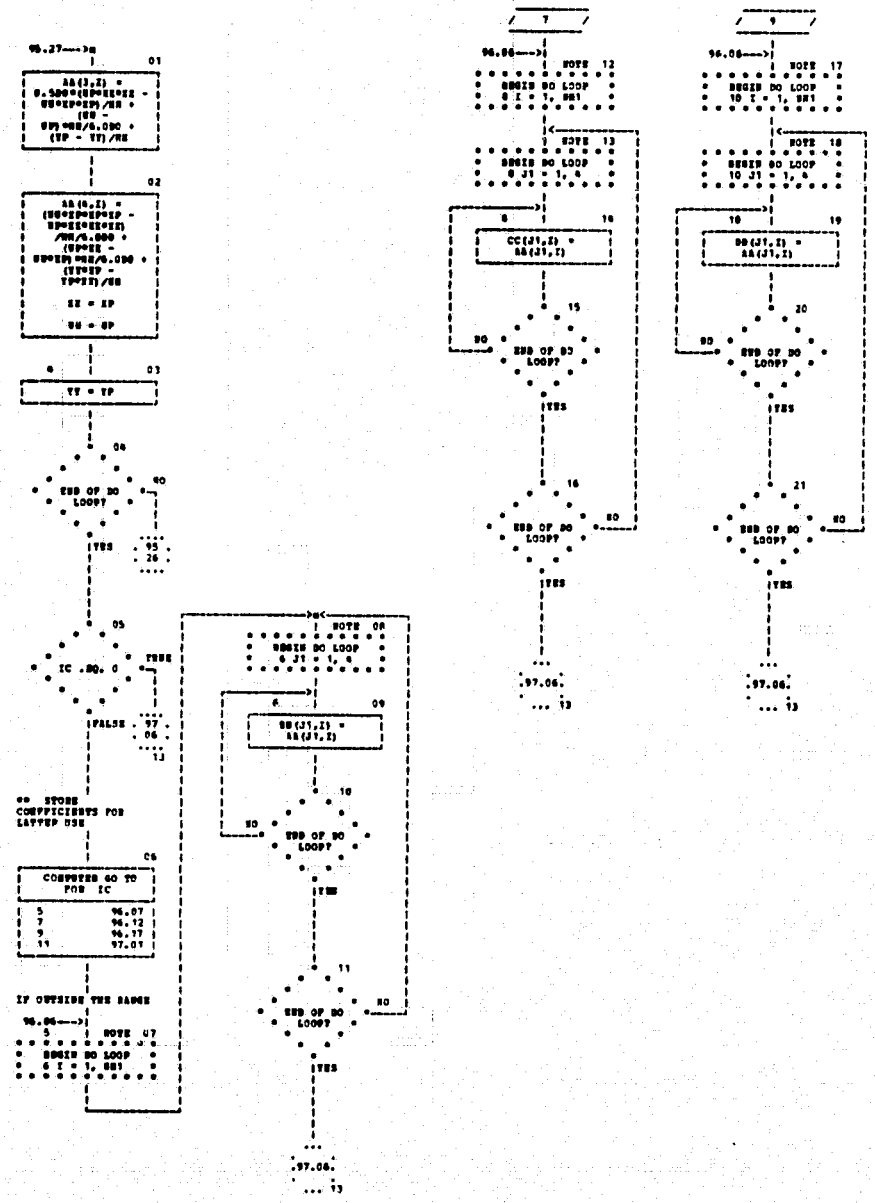


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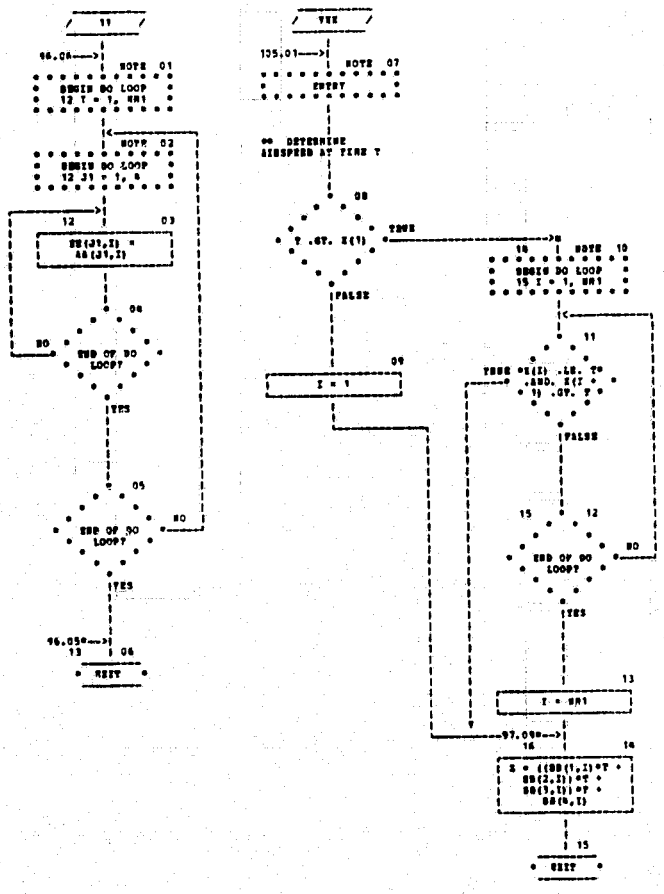
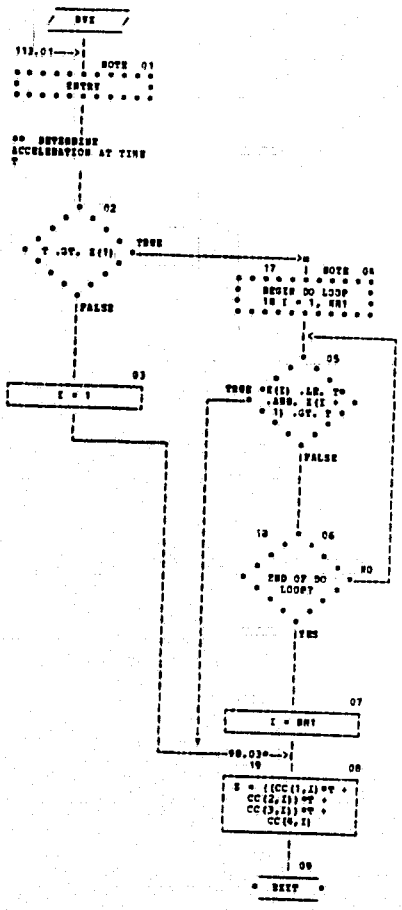
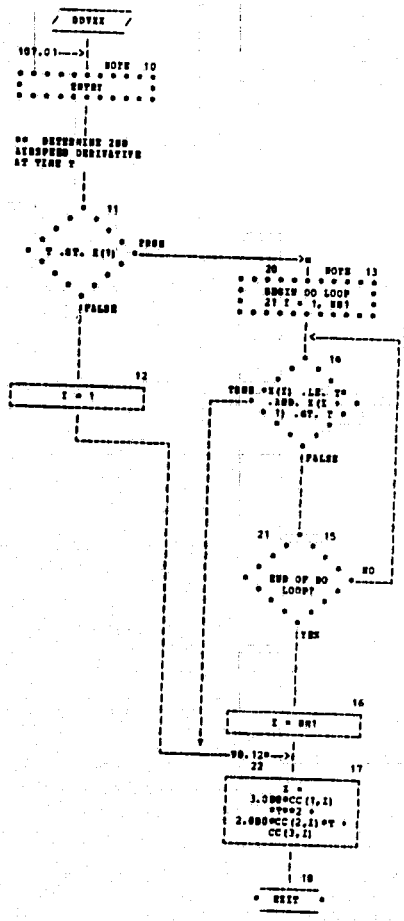


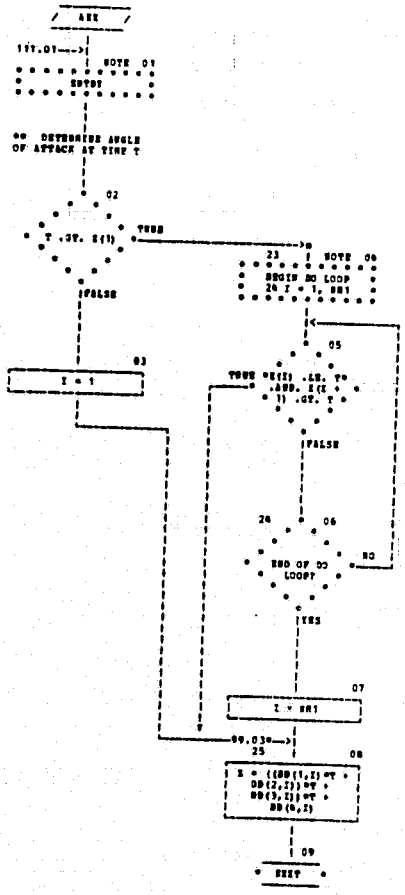
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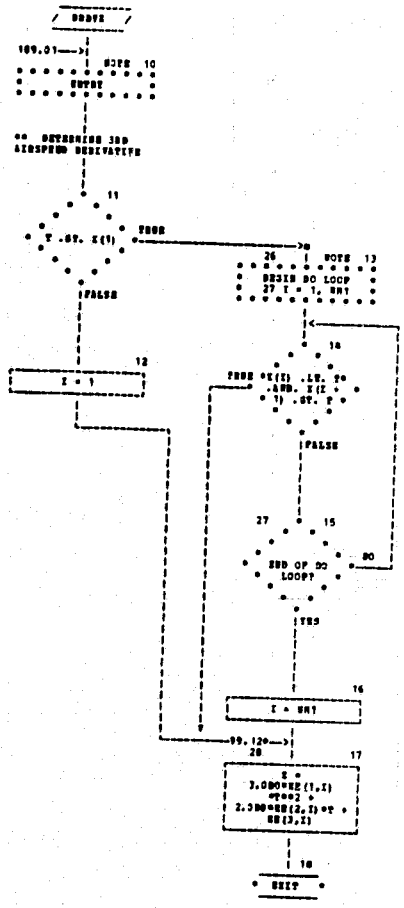
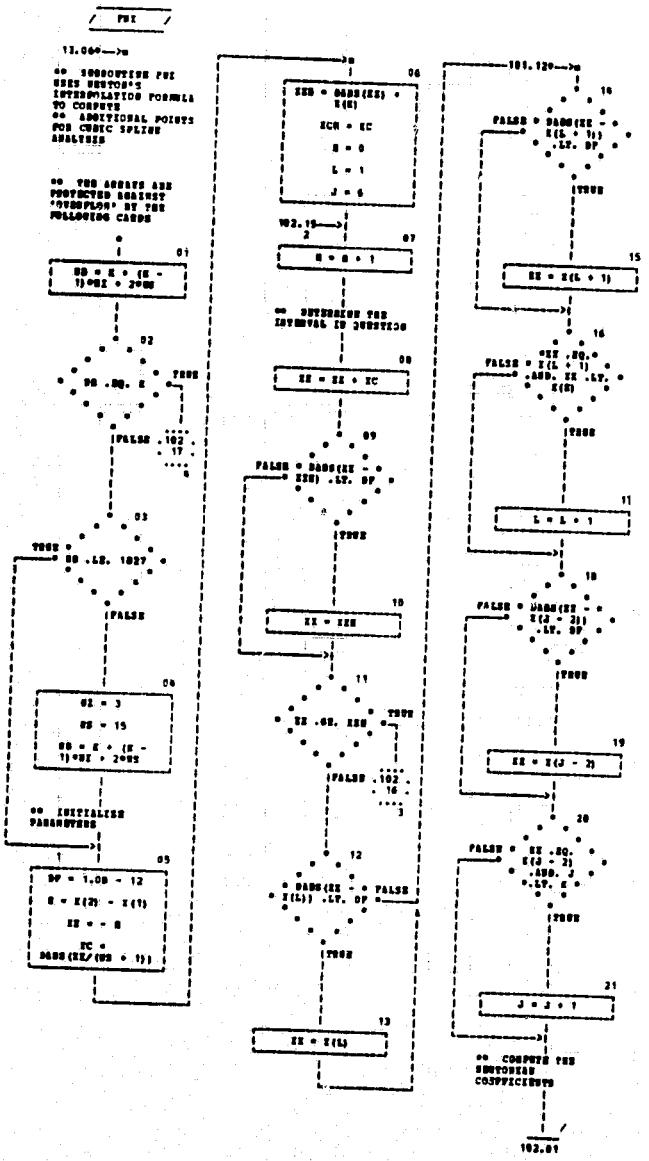


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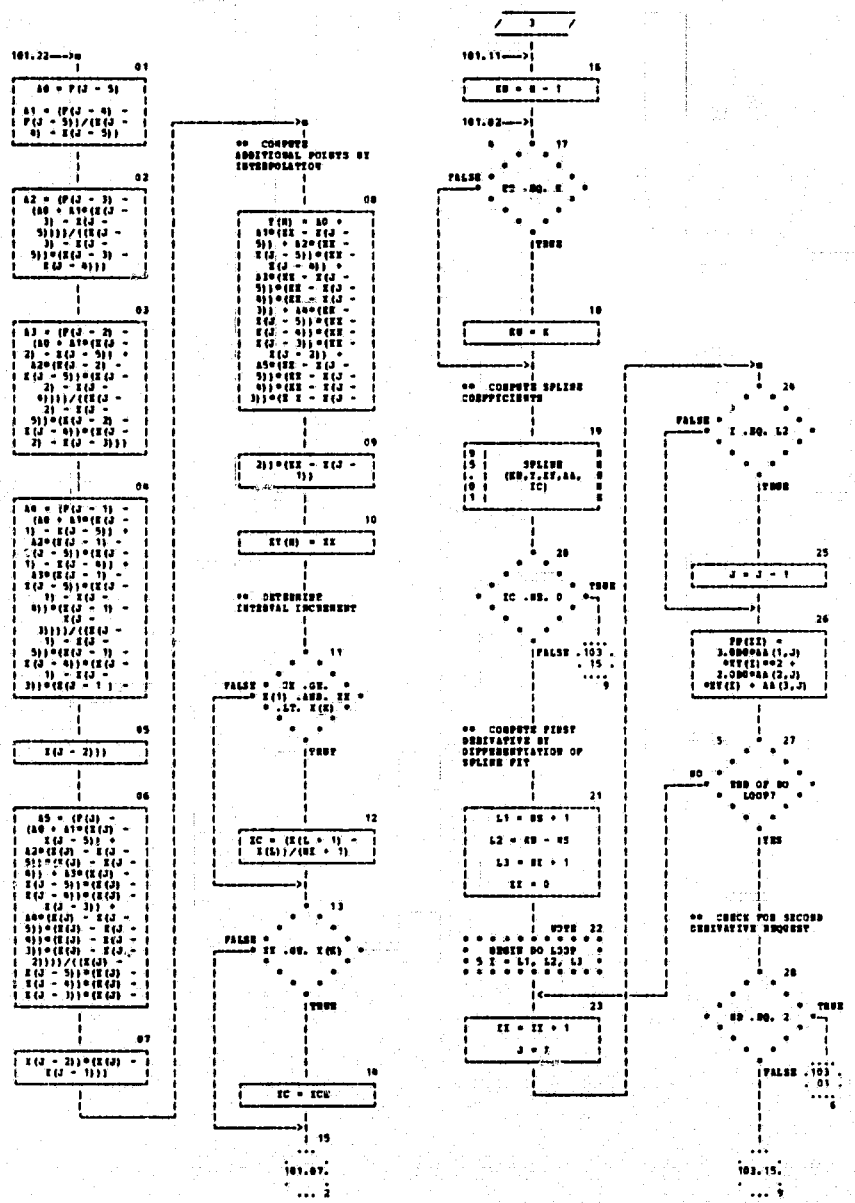
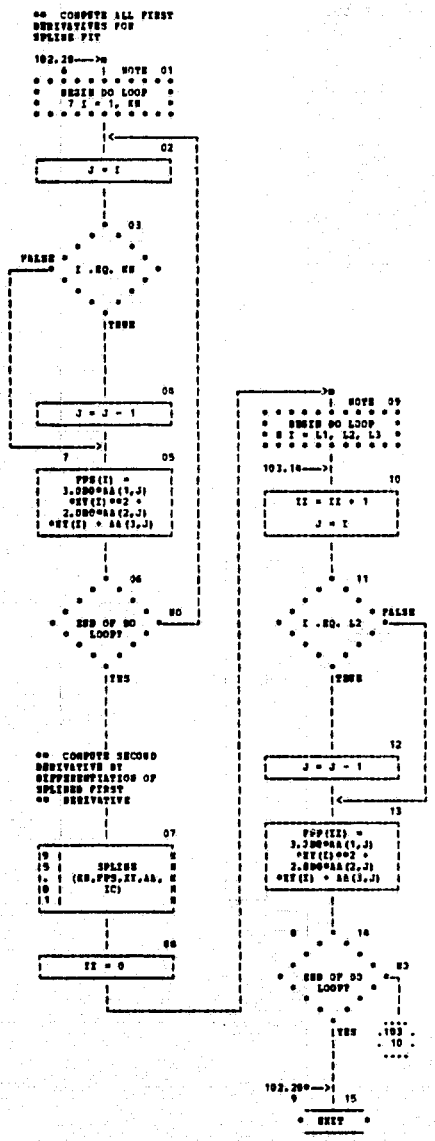


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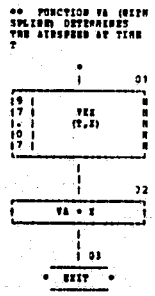


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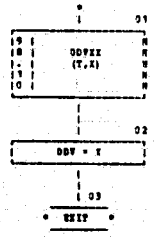


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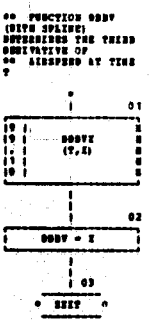
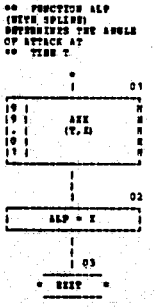


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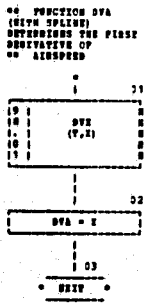
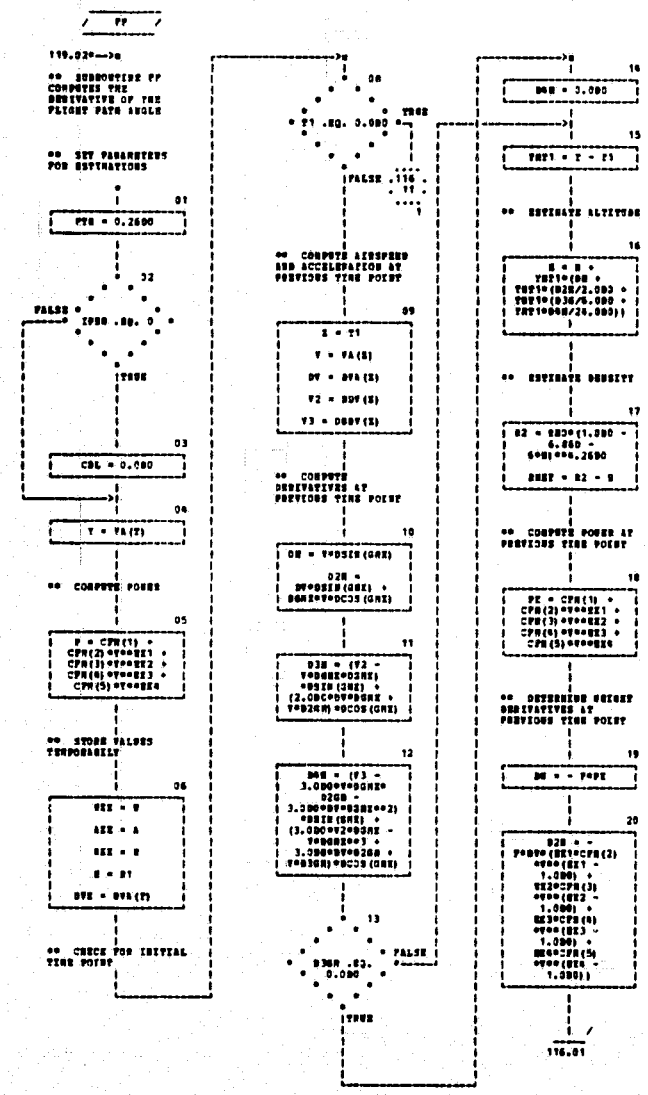


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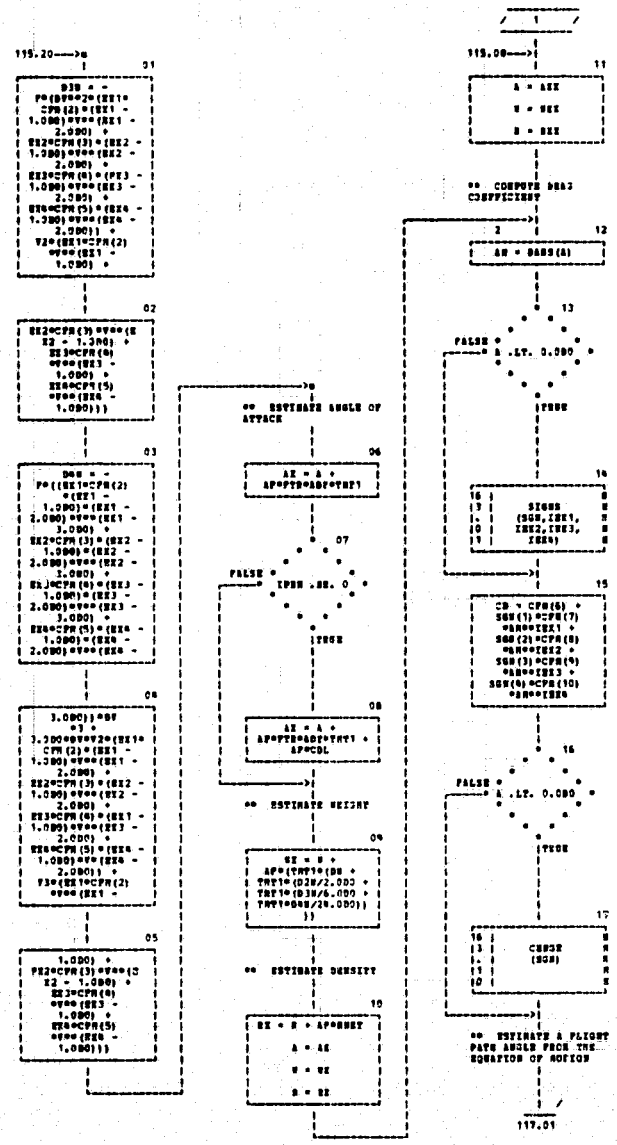
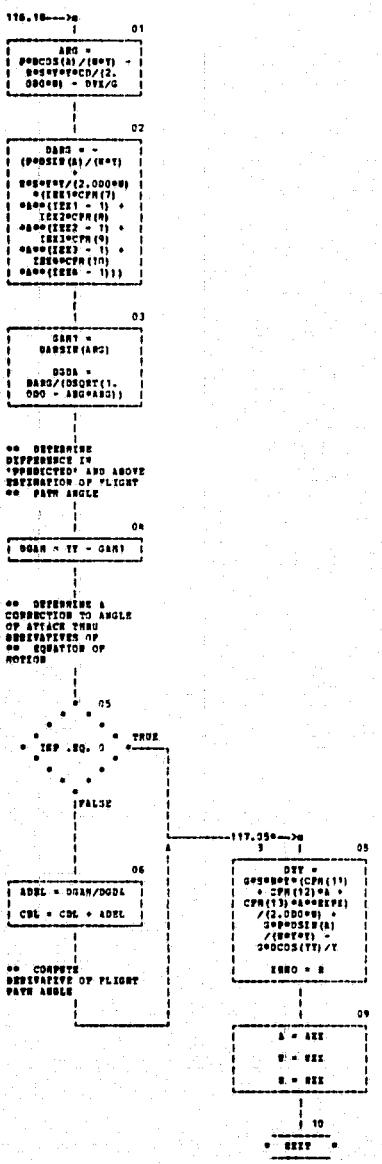


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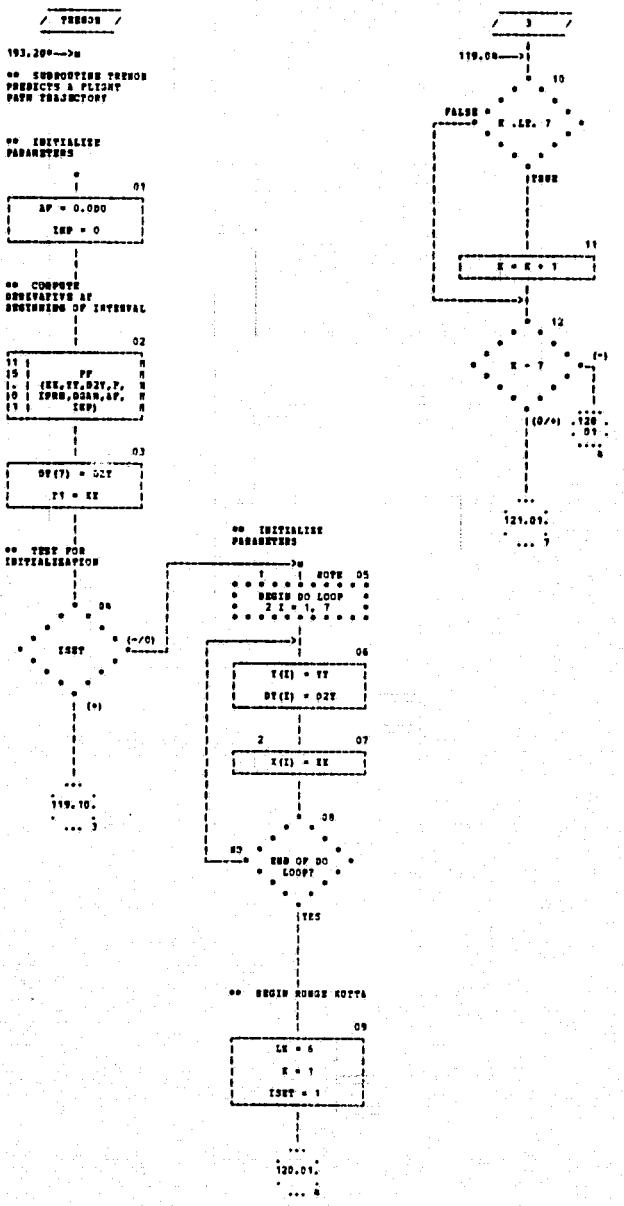
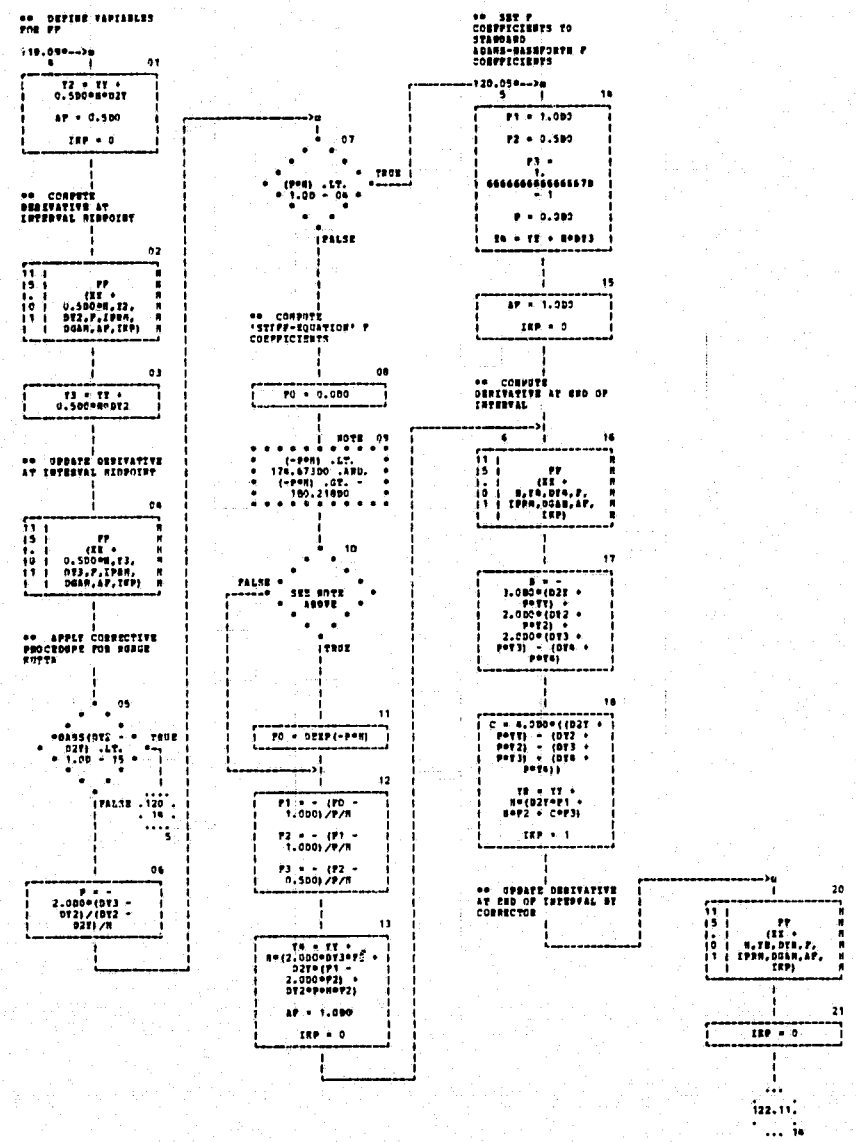


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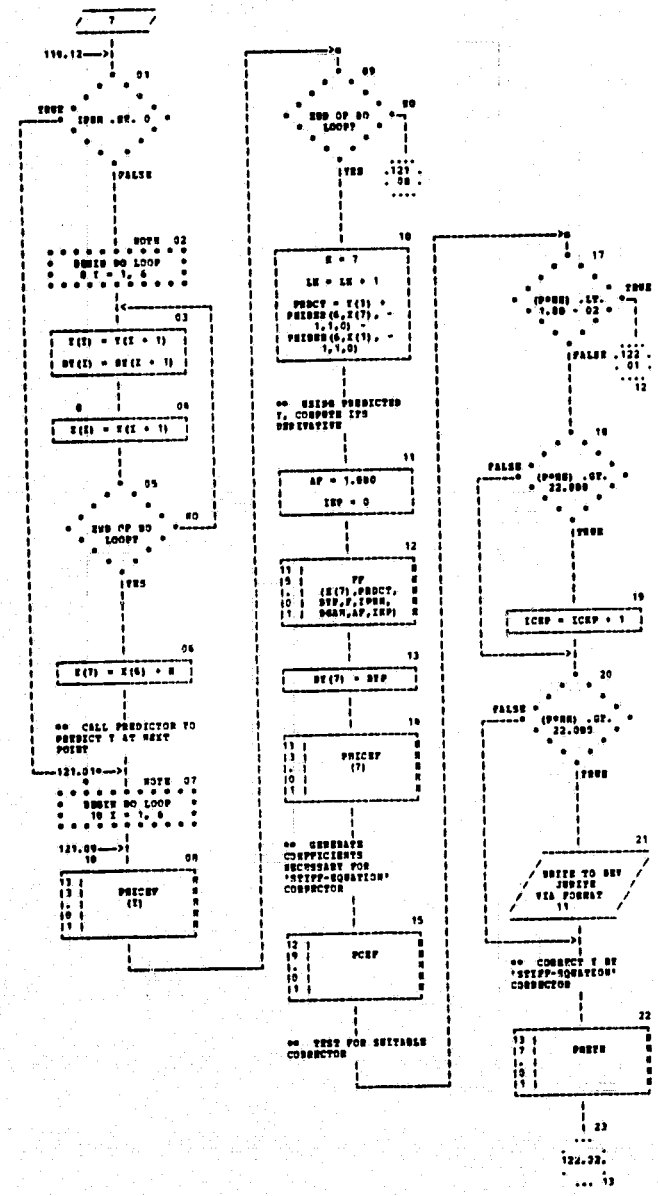
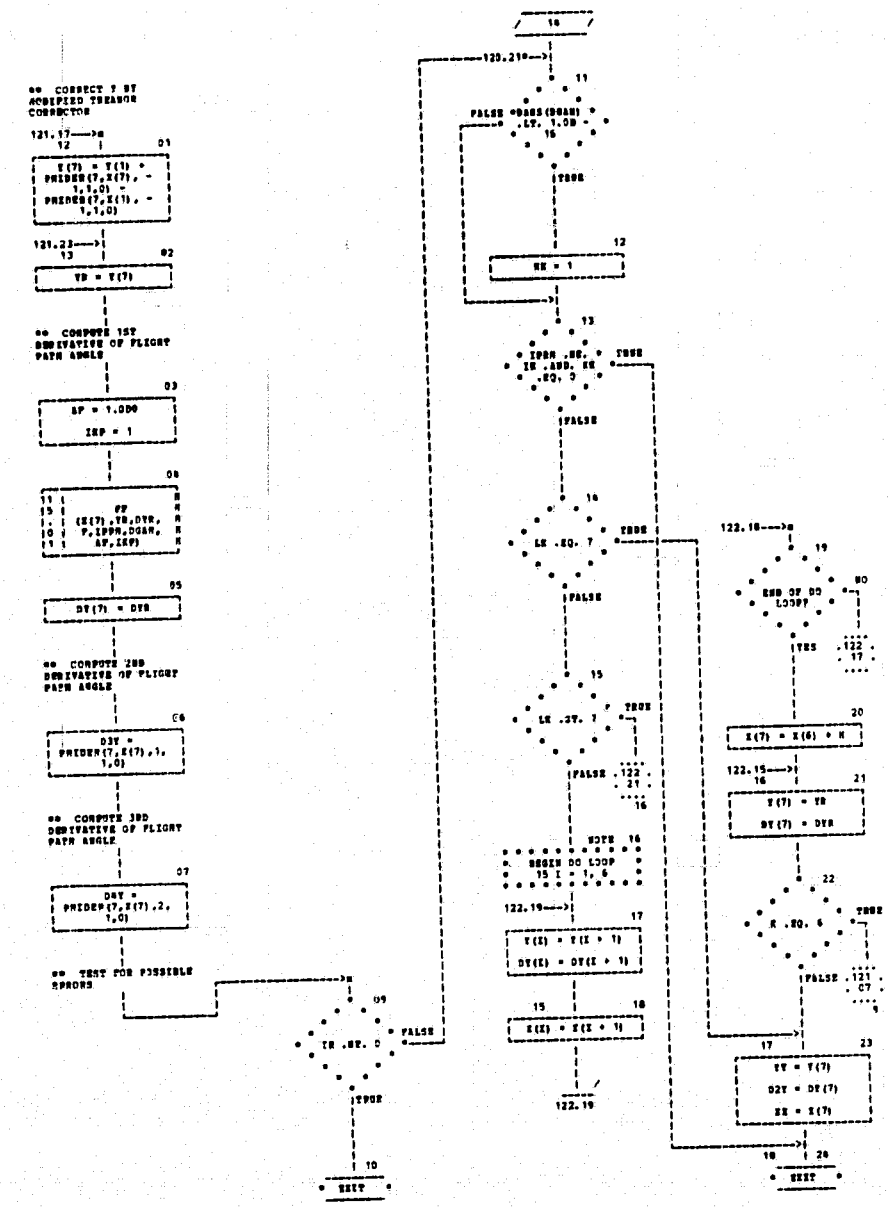


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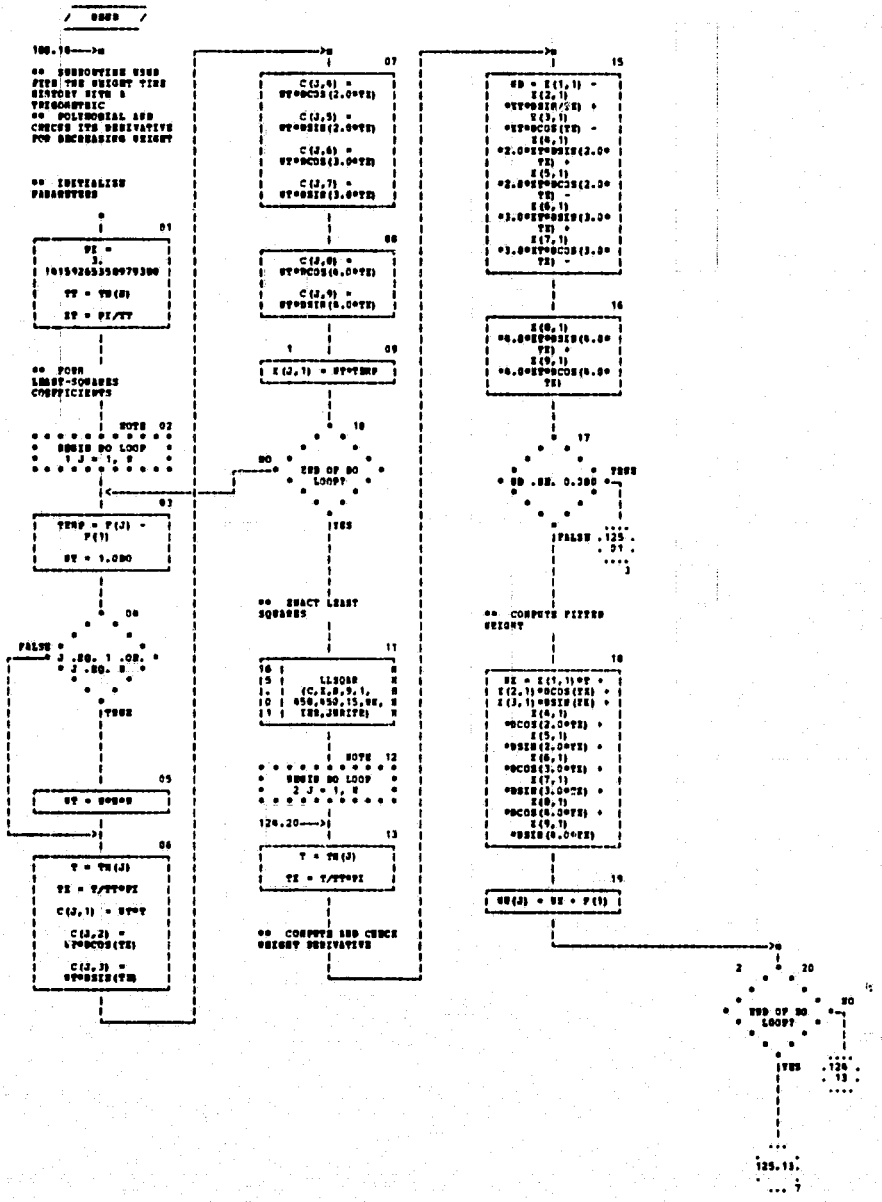
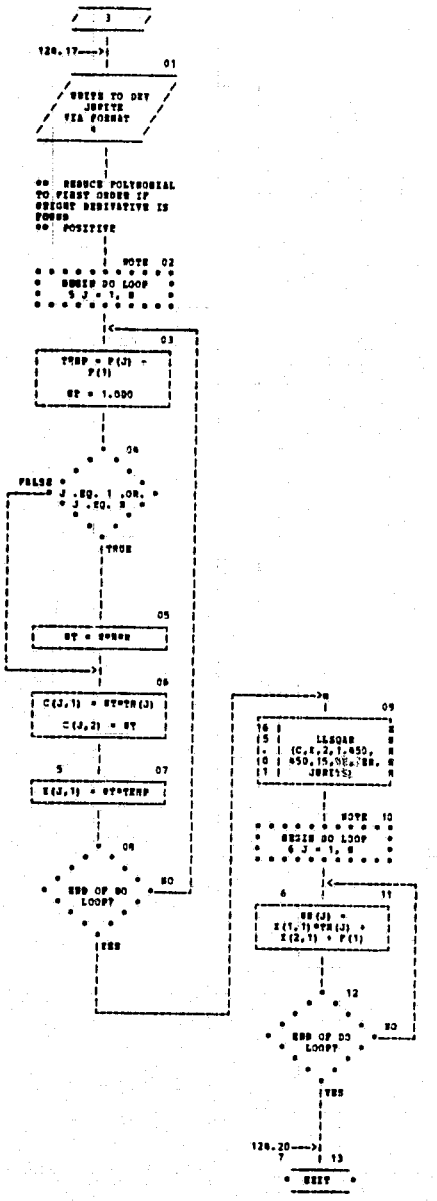


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C-7

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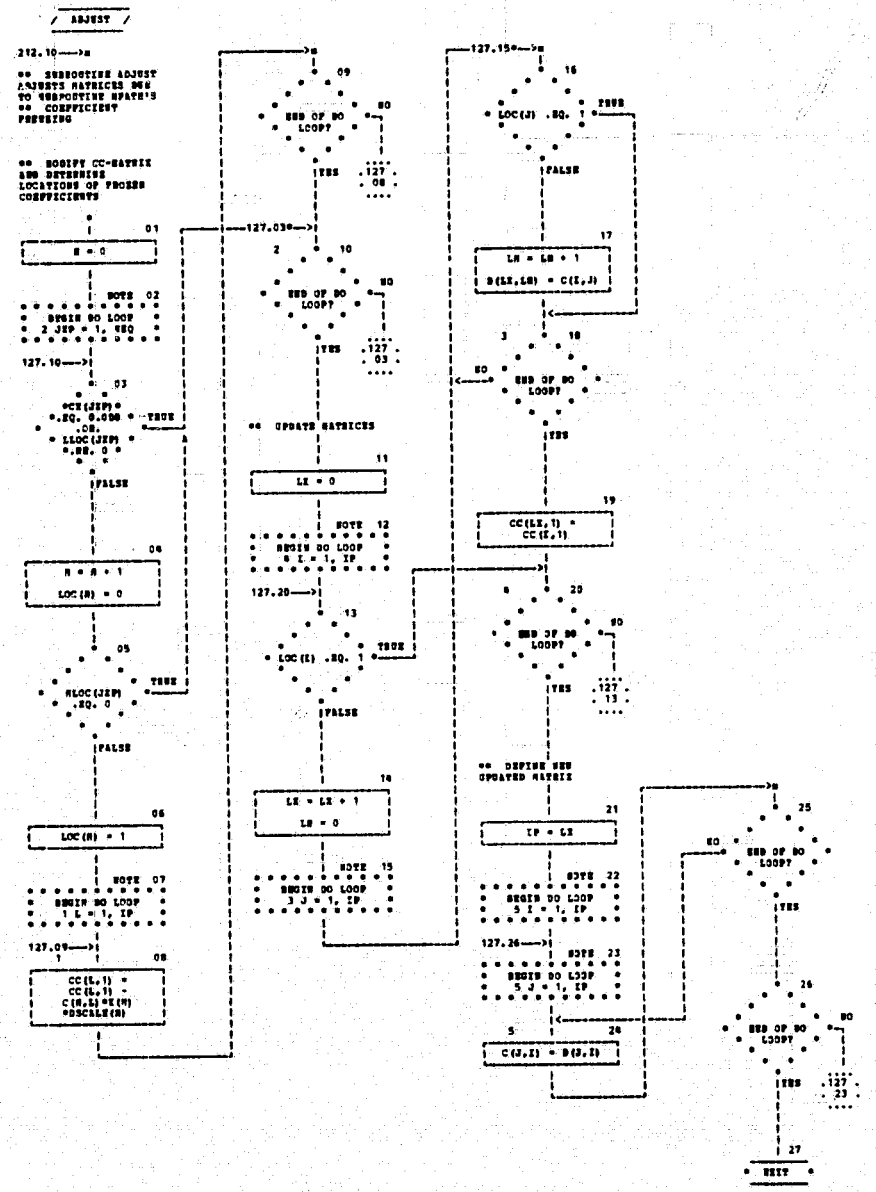


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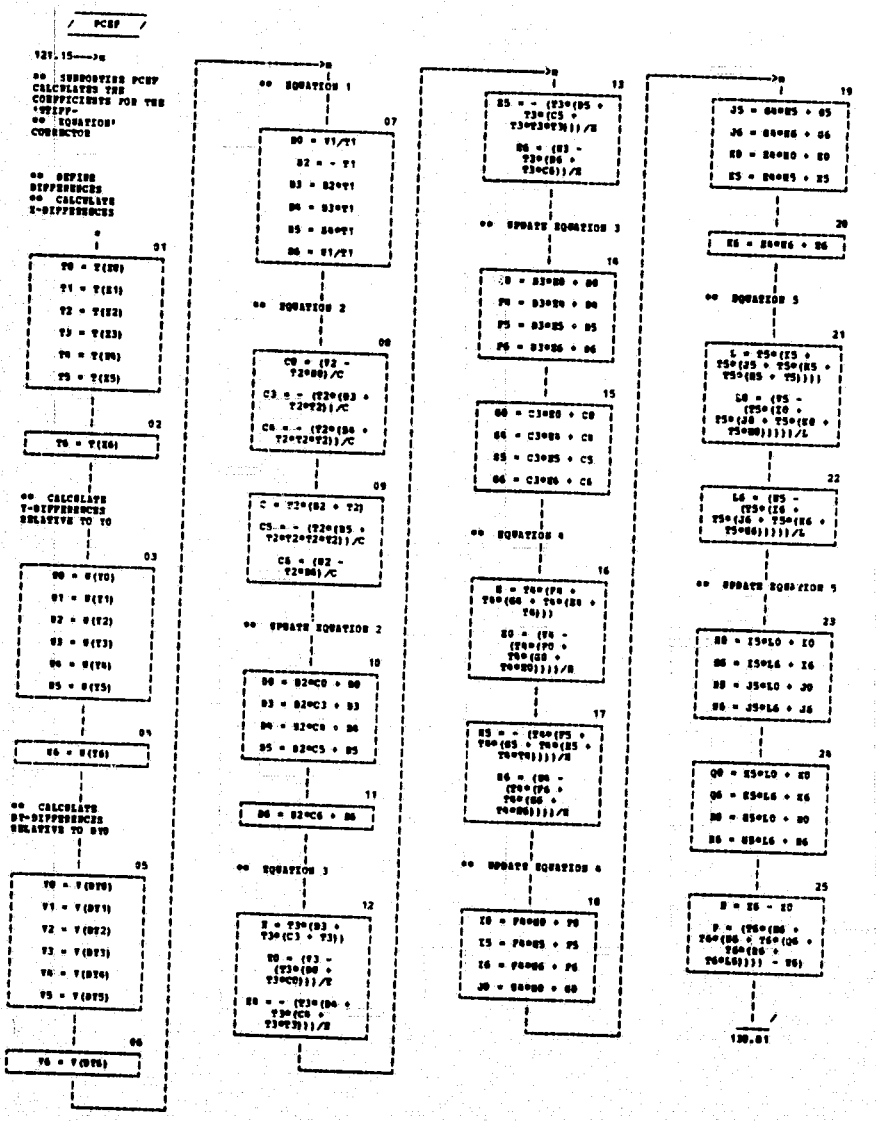
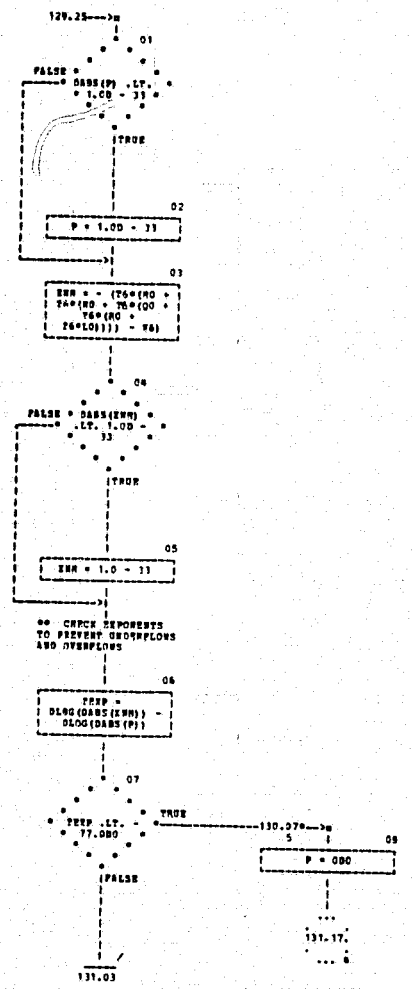
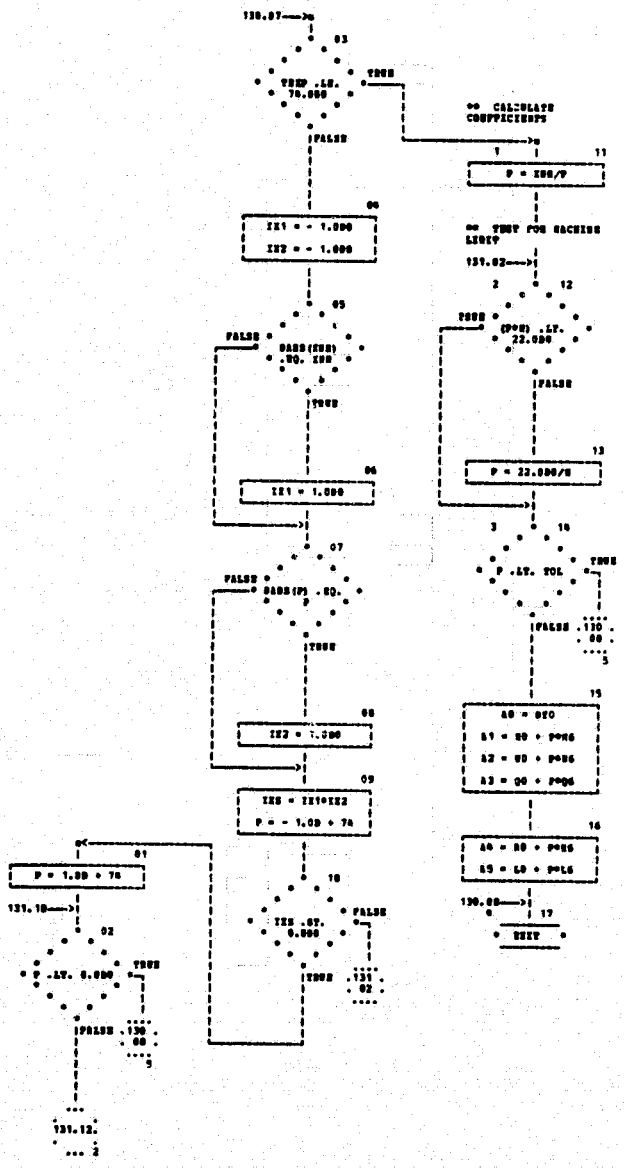


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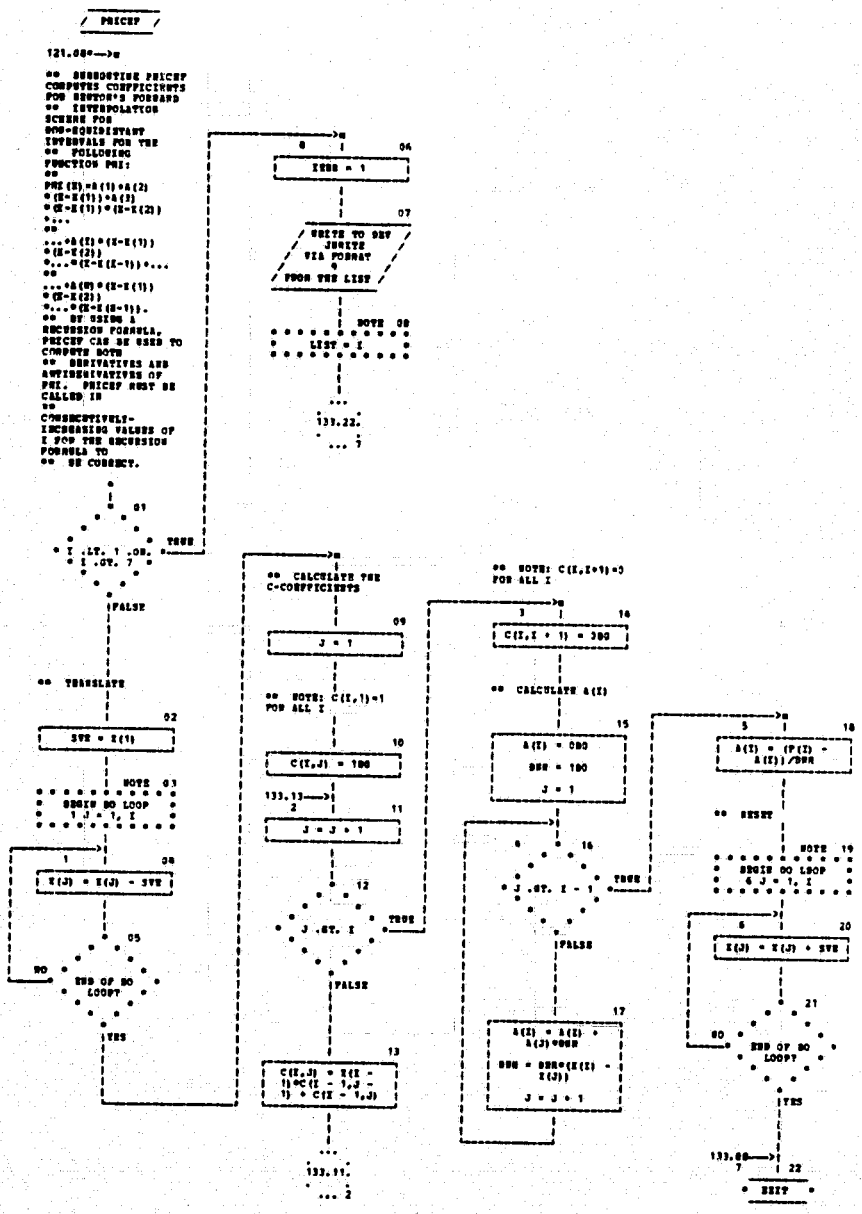
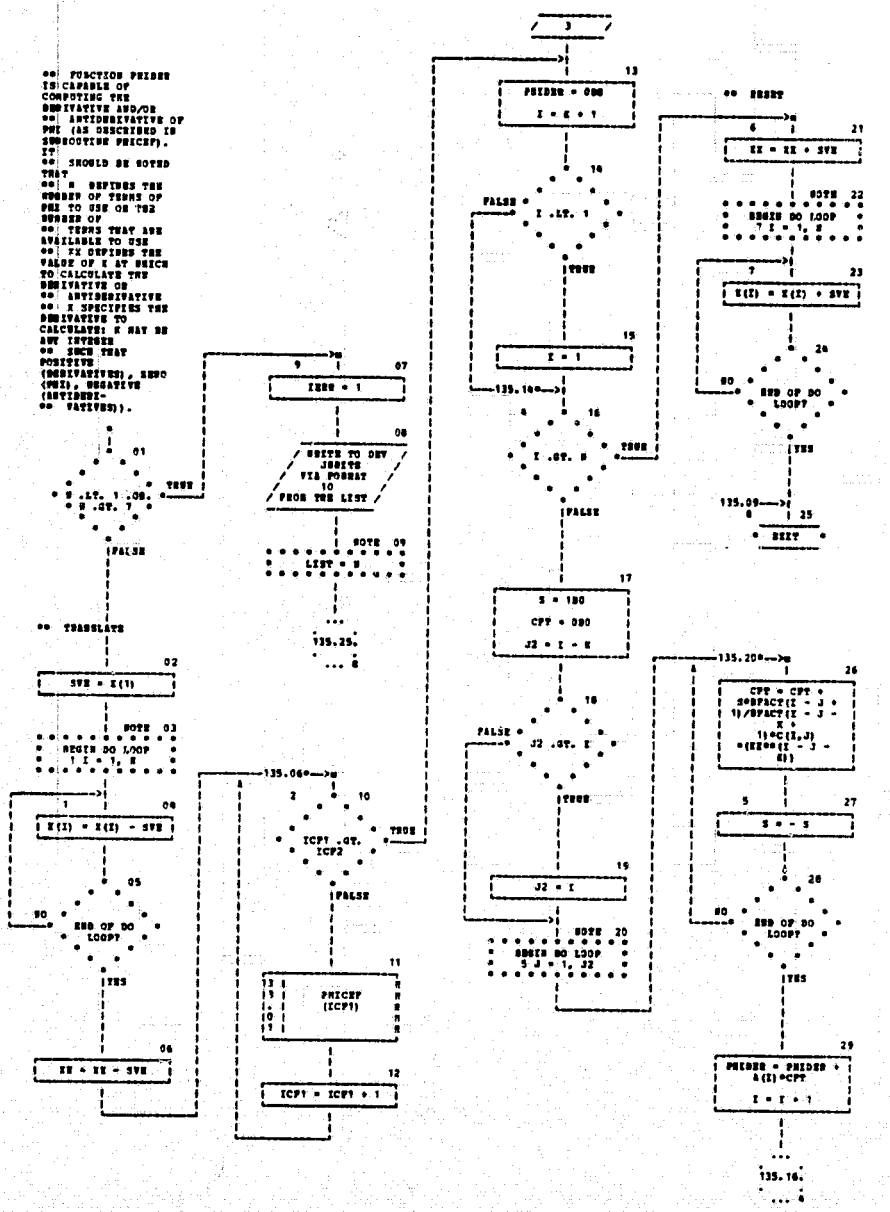


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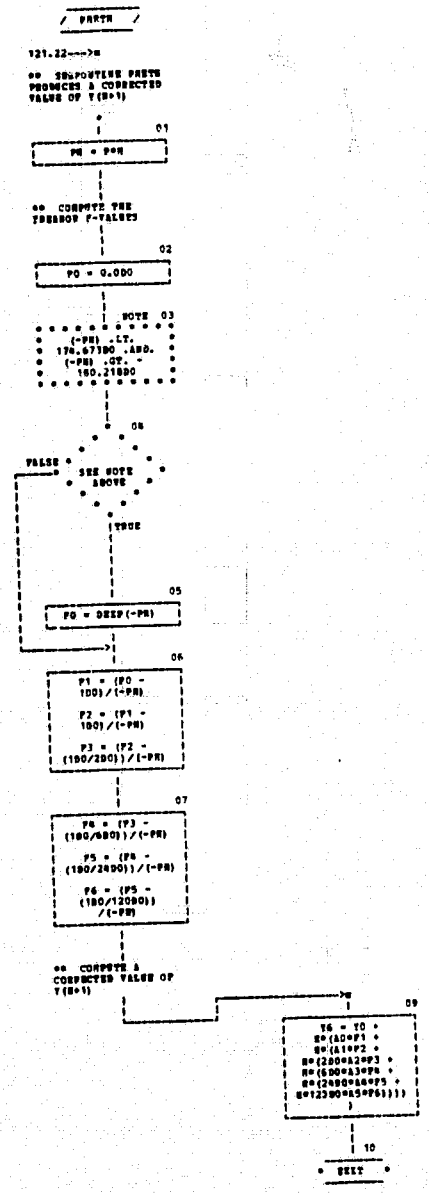
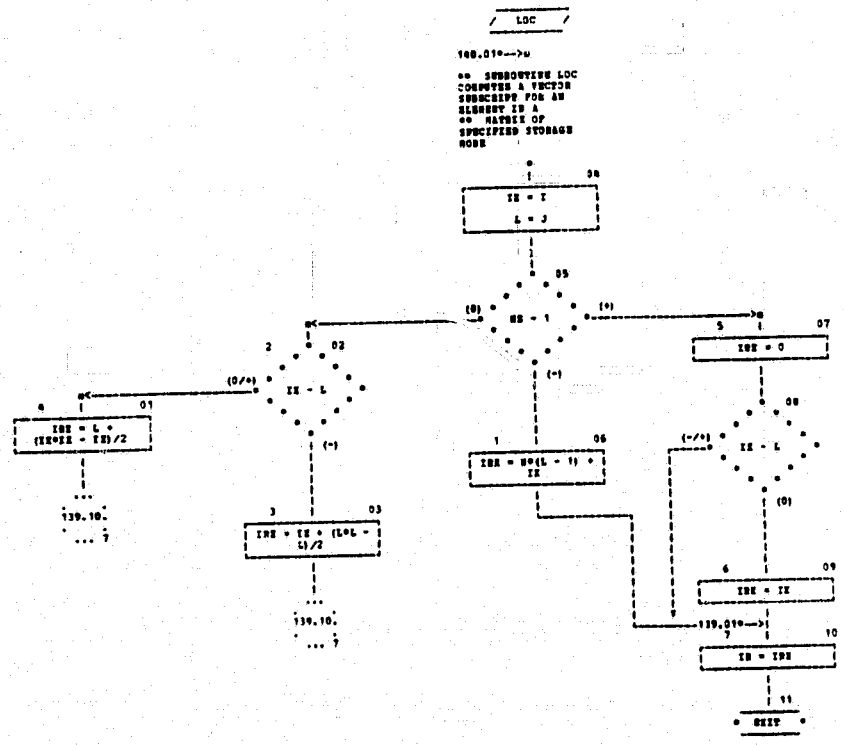


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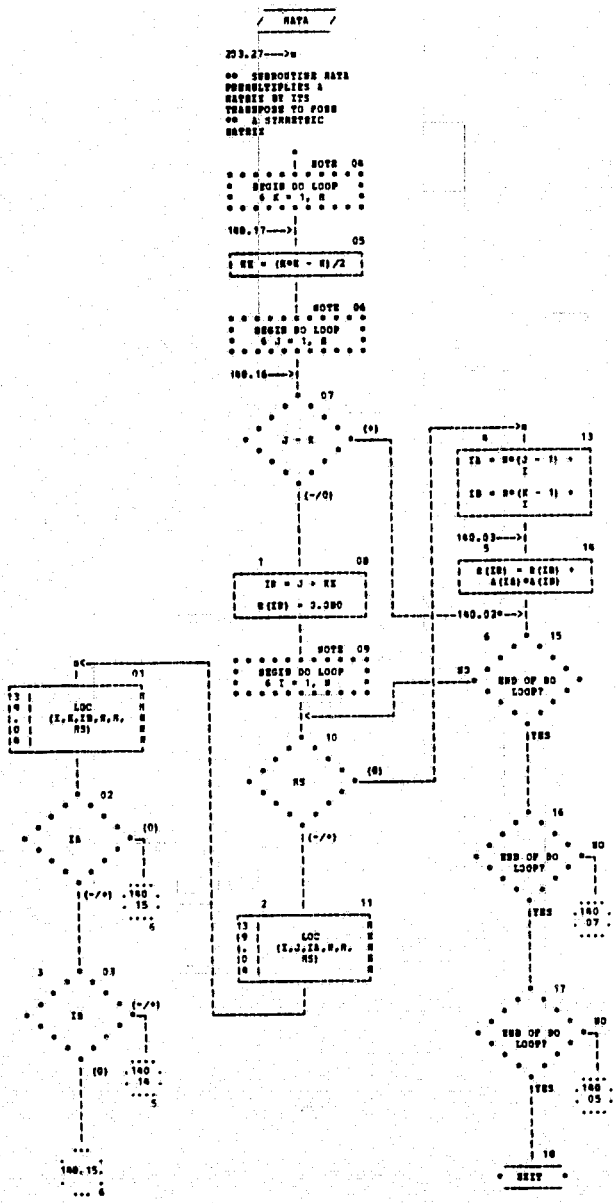


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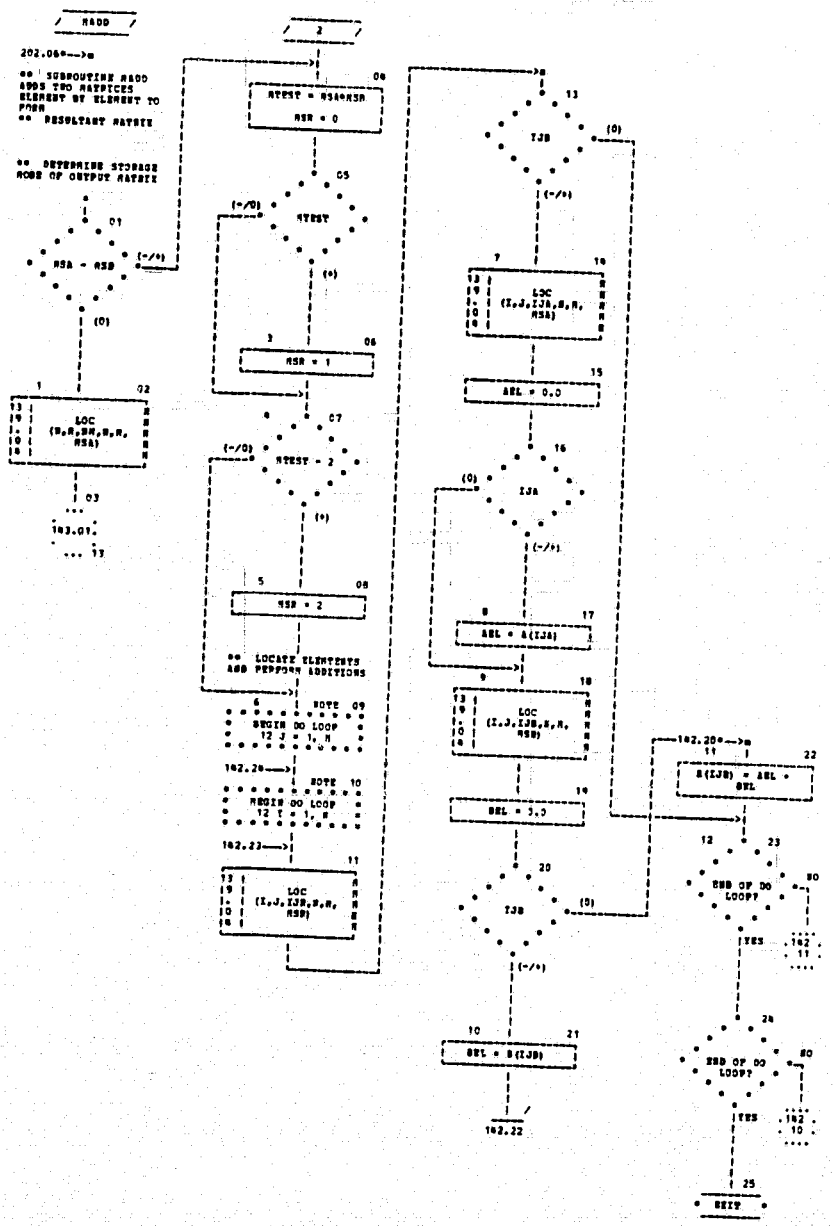
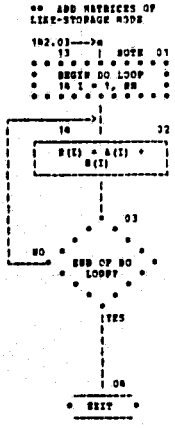
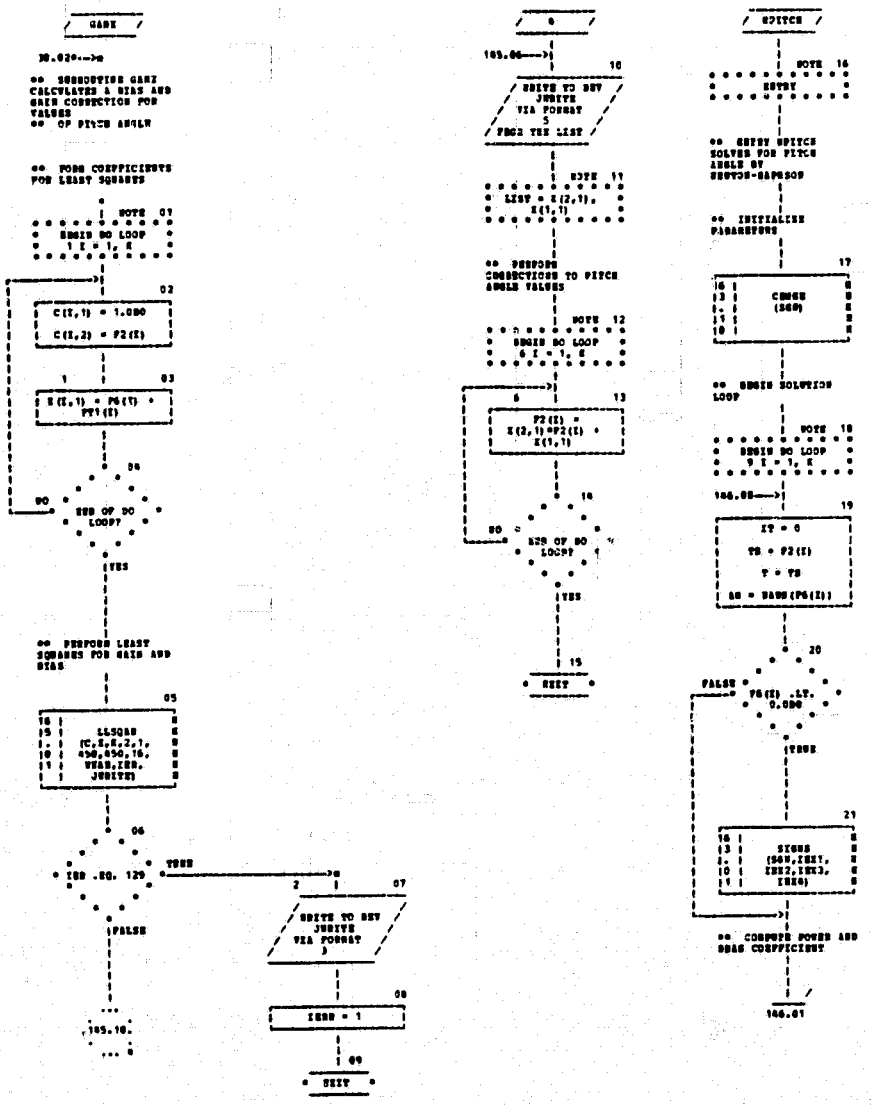


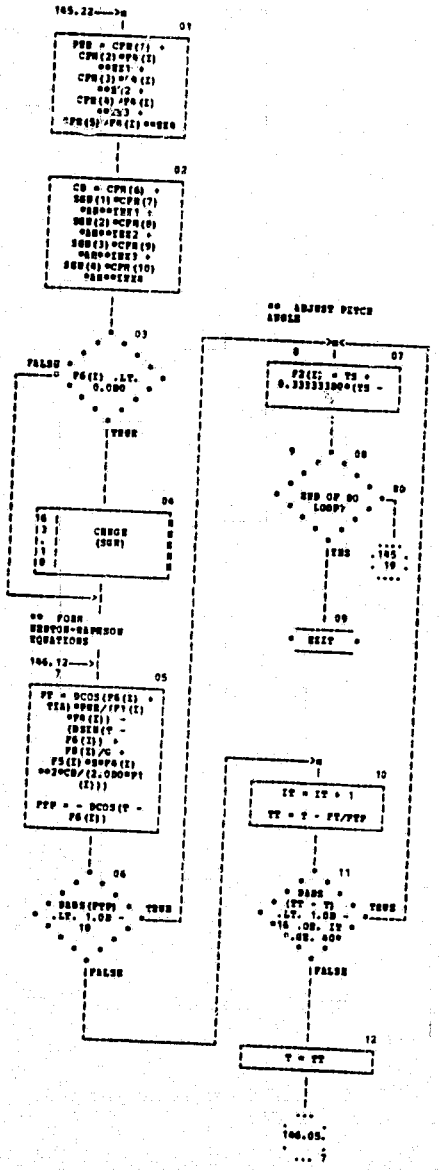
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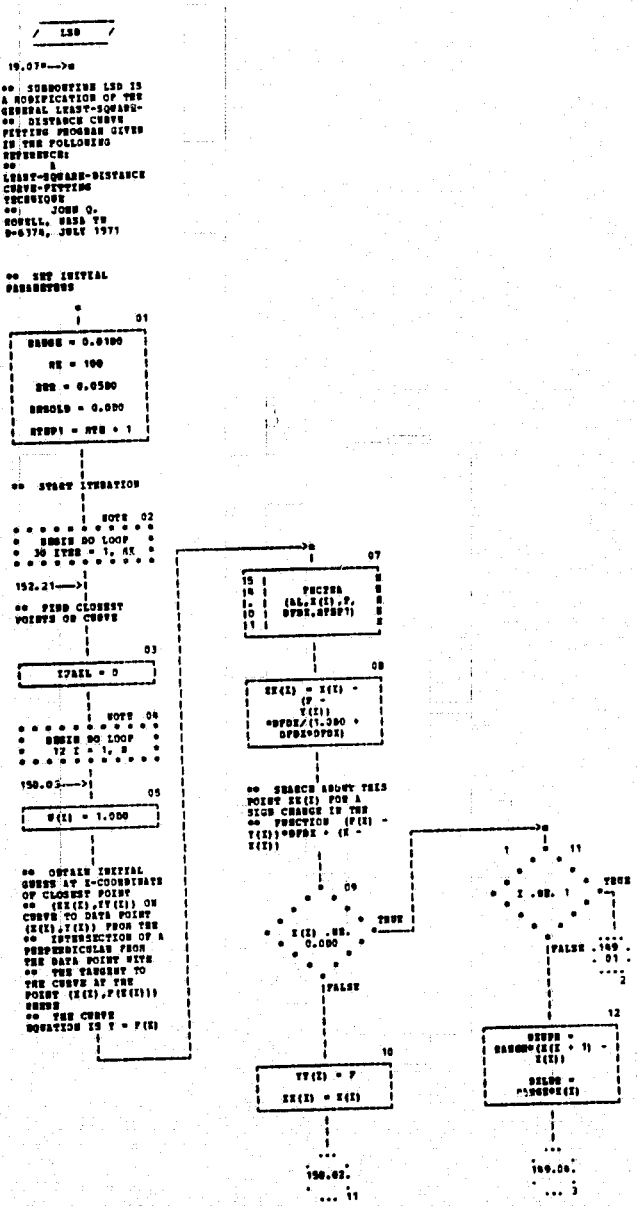
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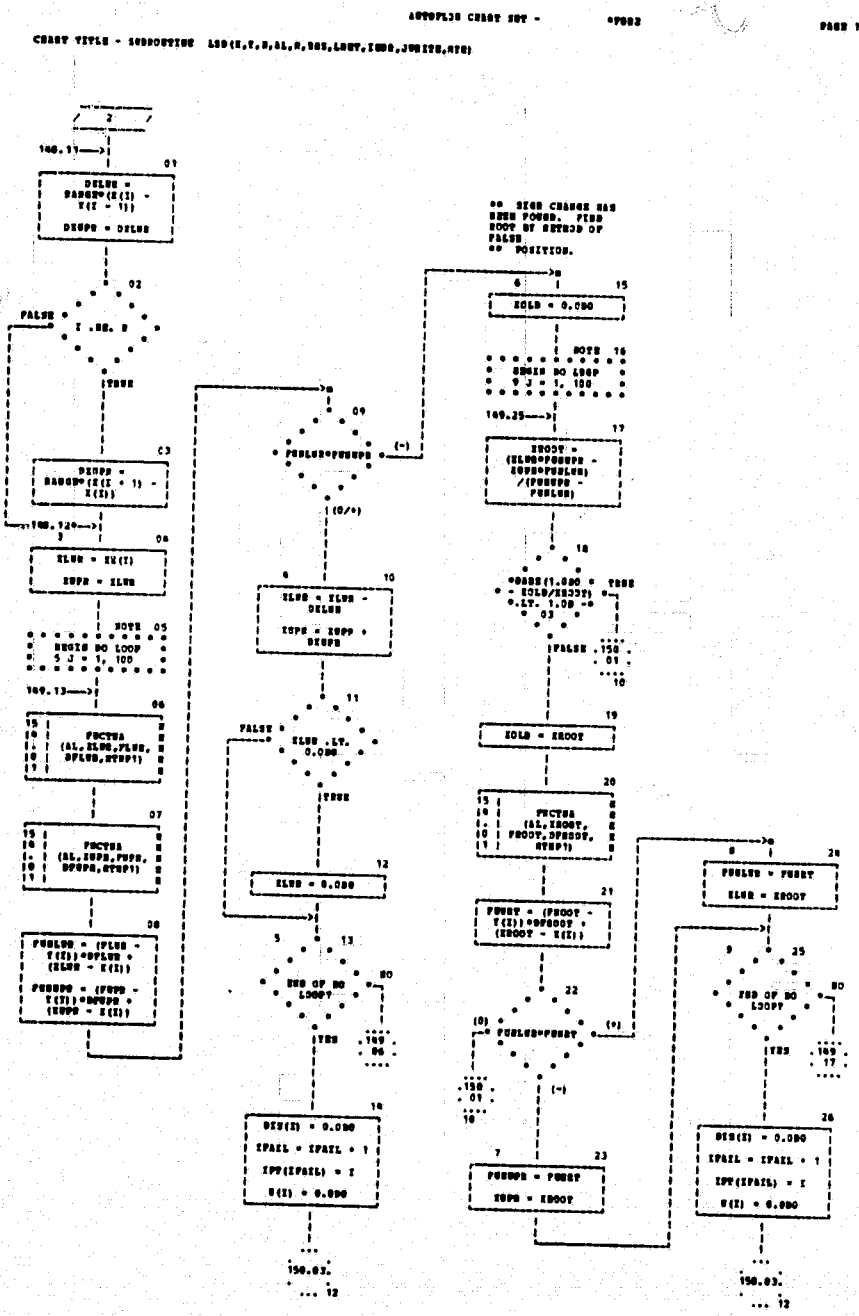
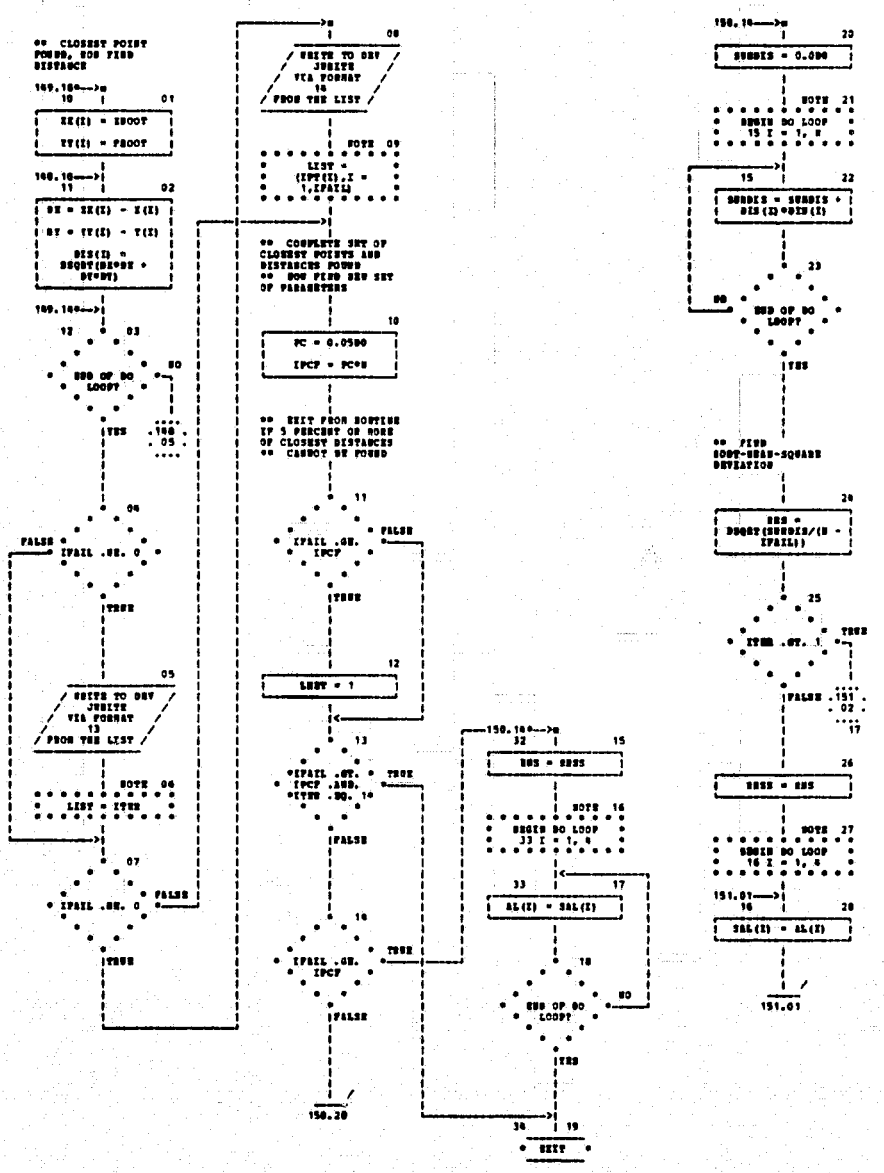


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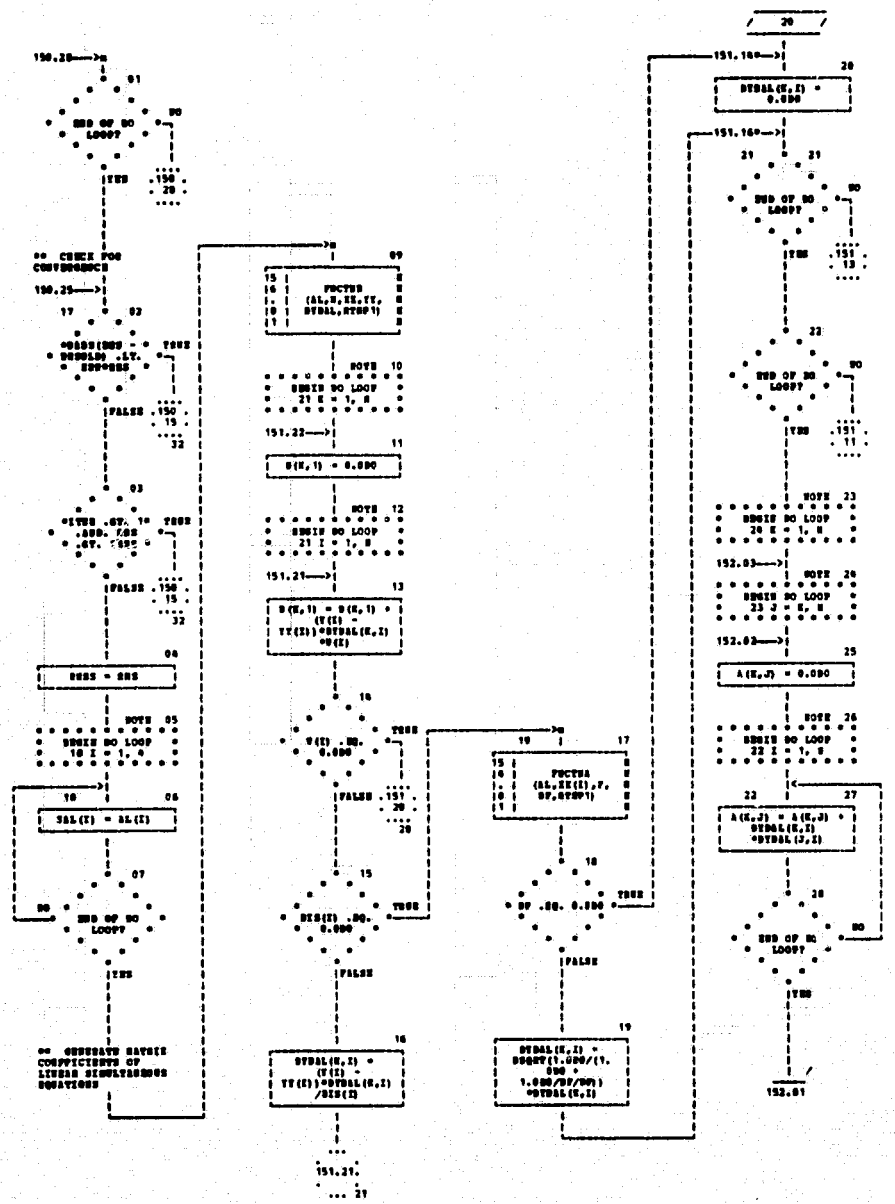
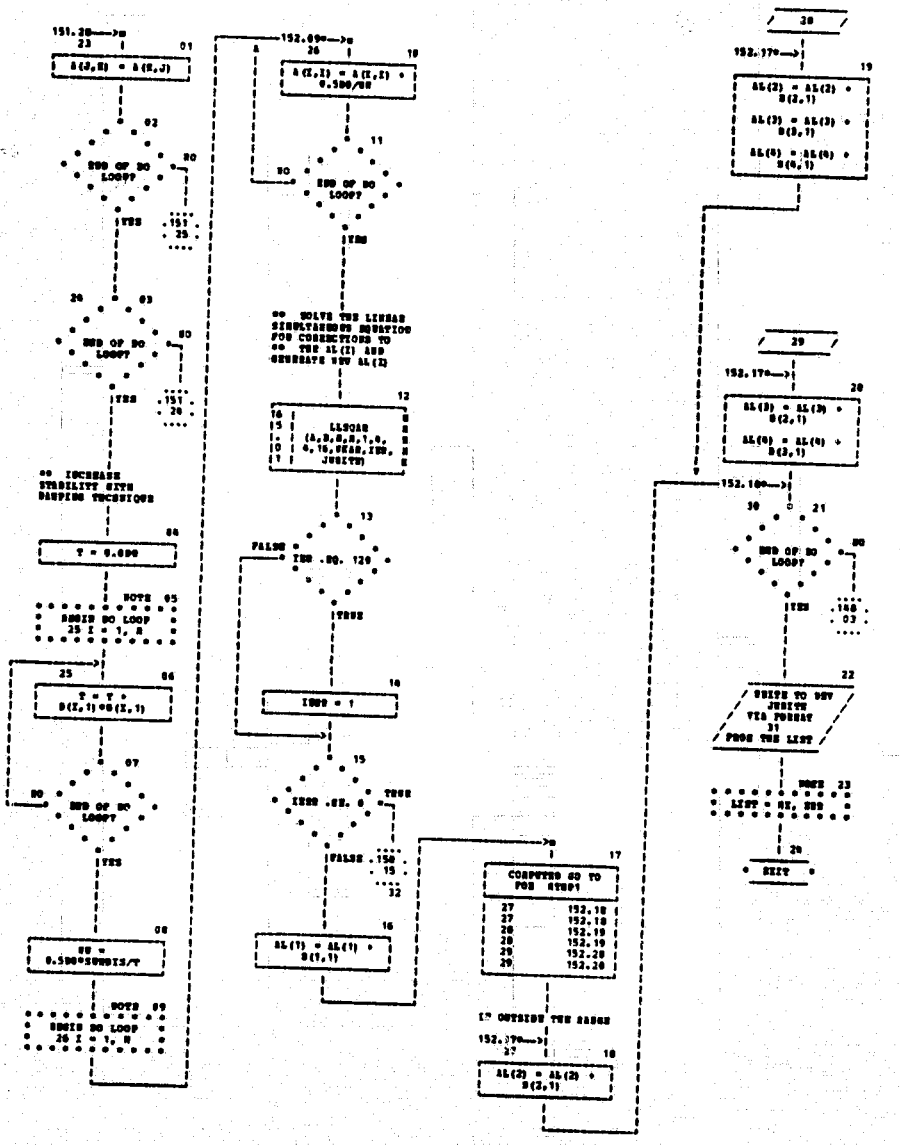


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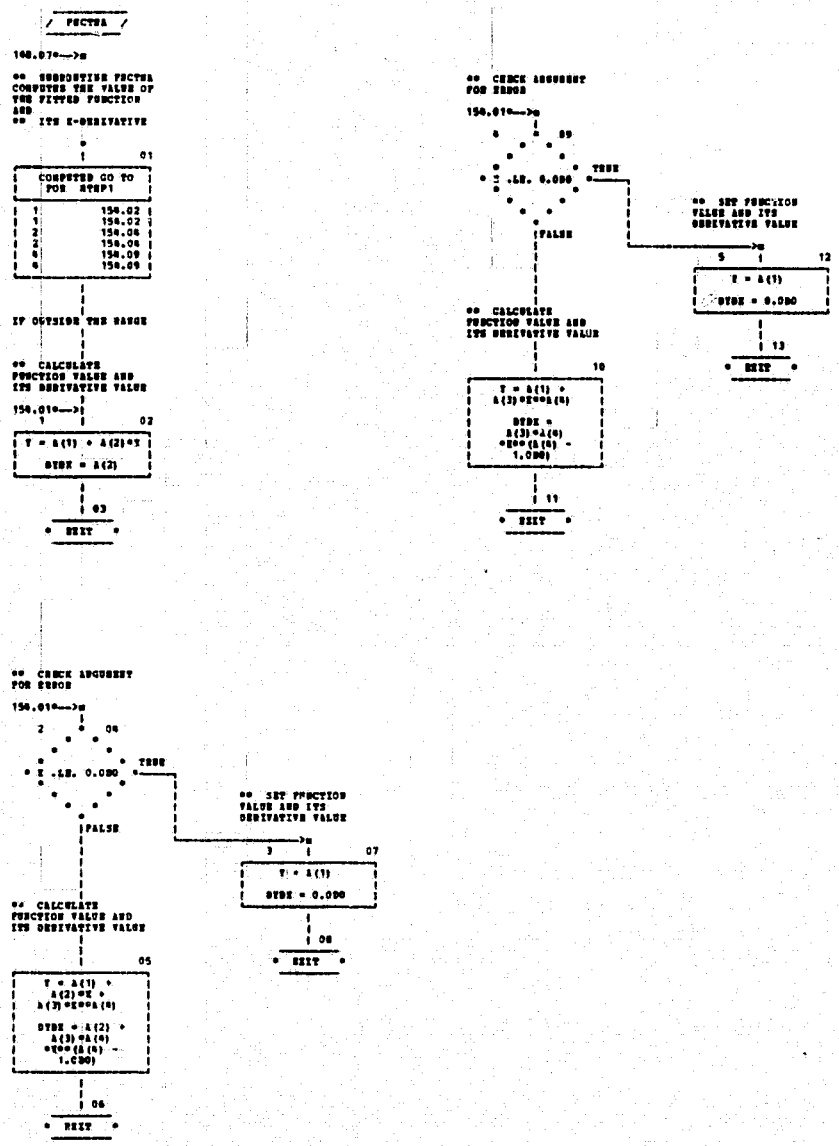
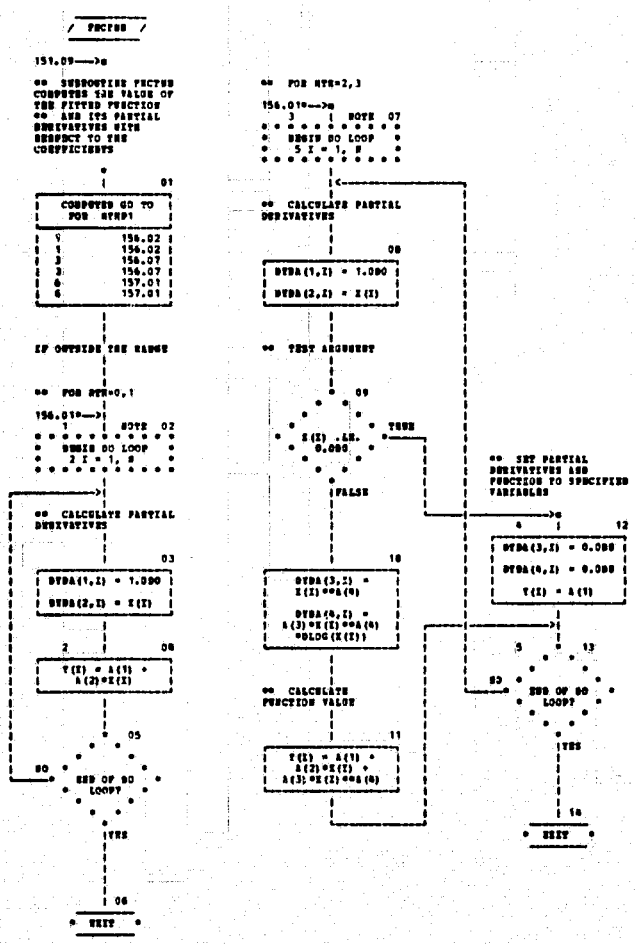


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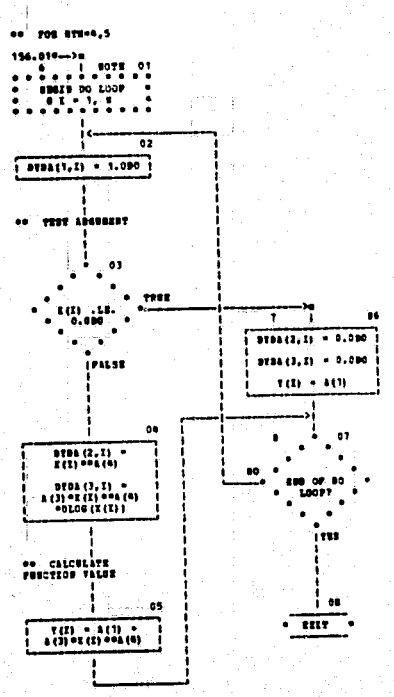
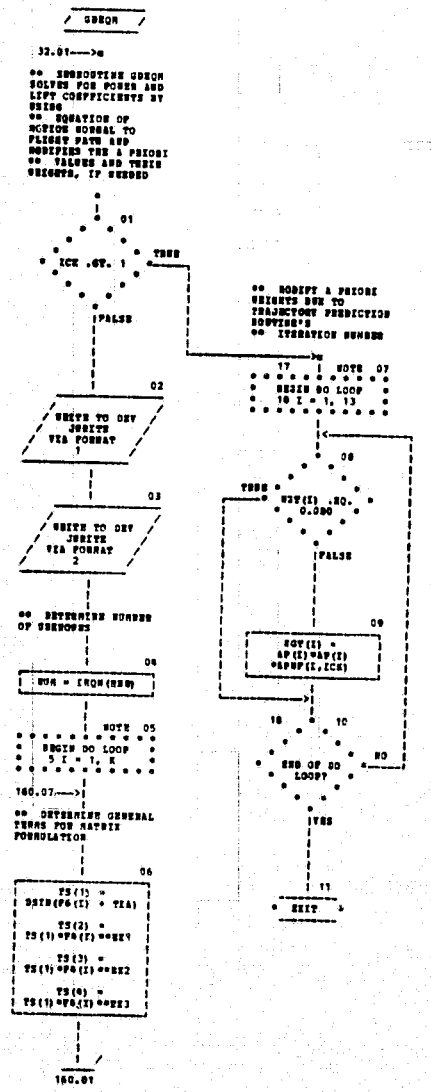


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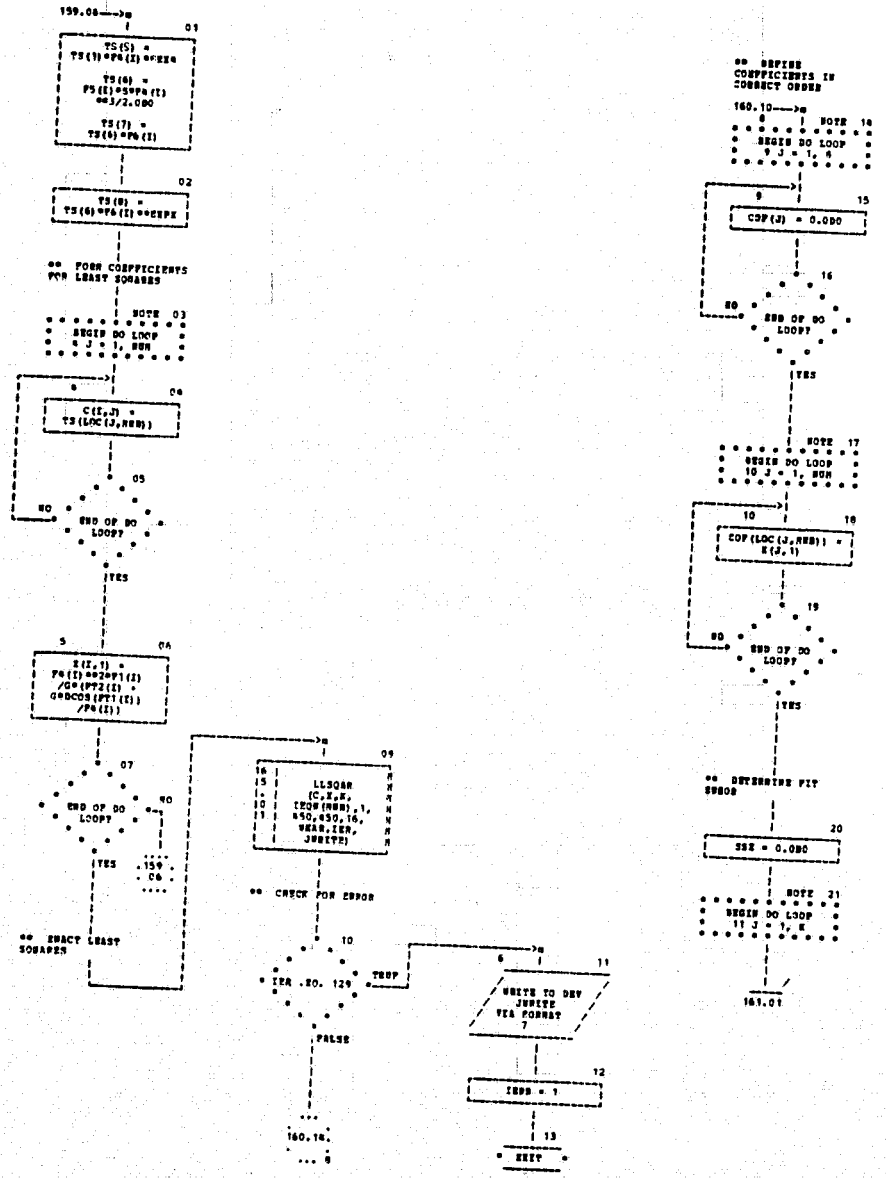
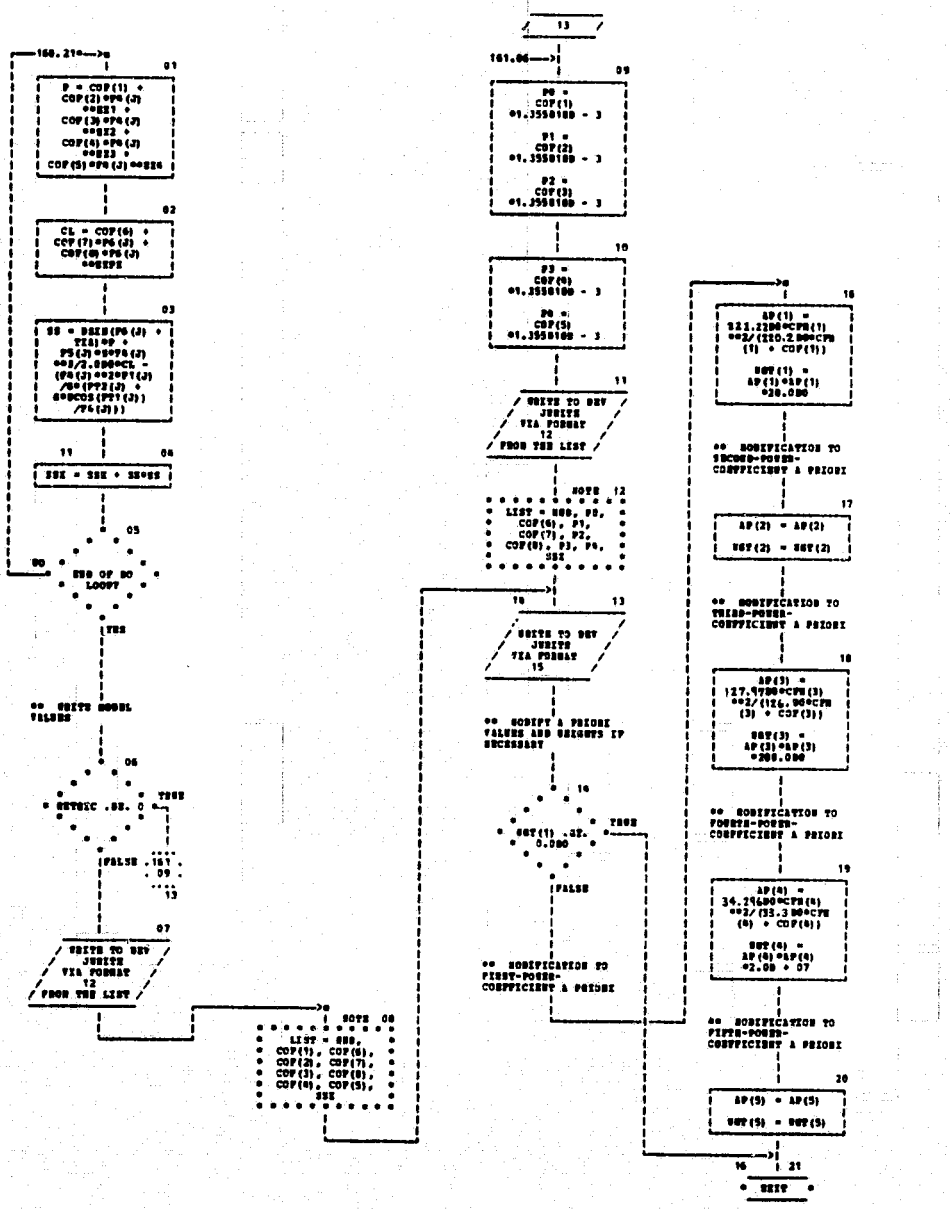


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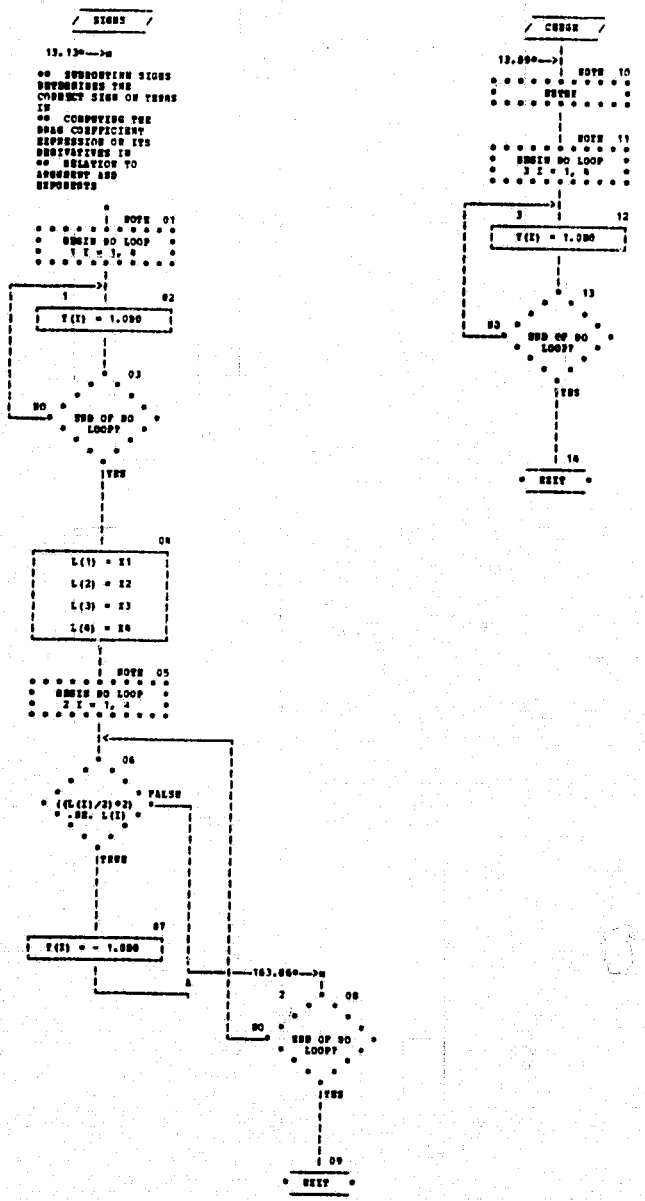
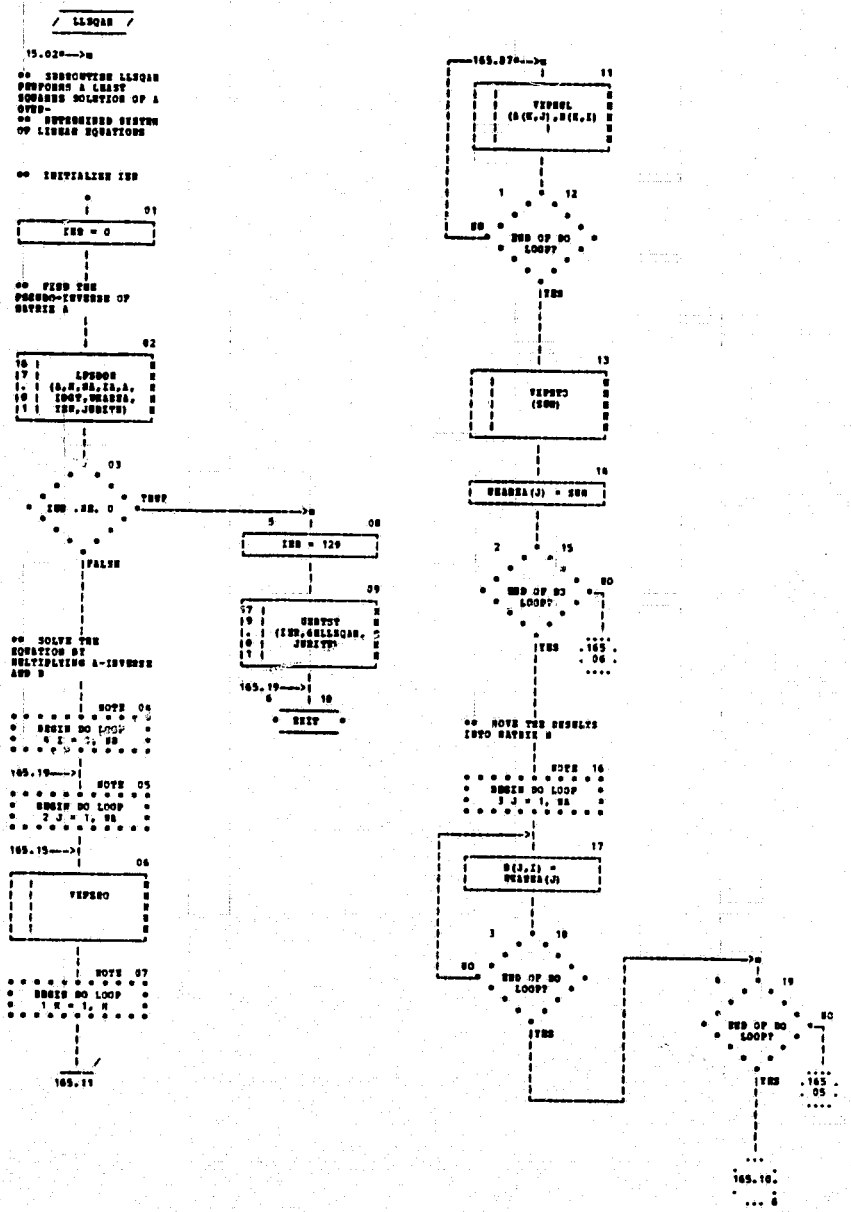


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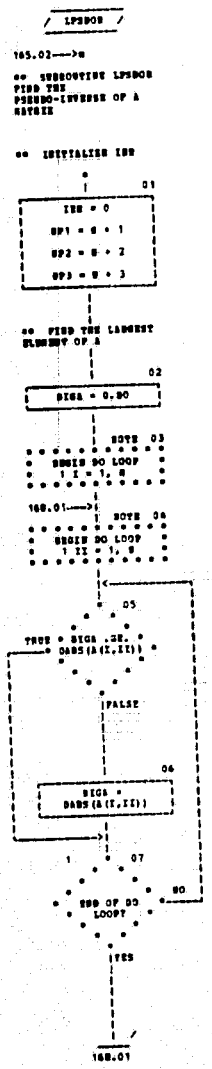
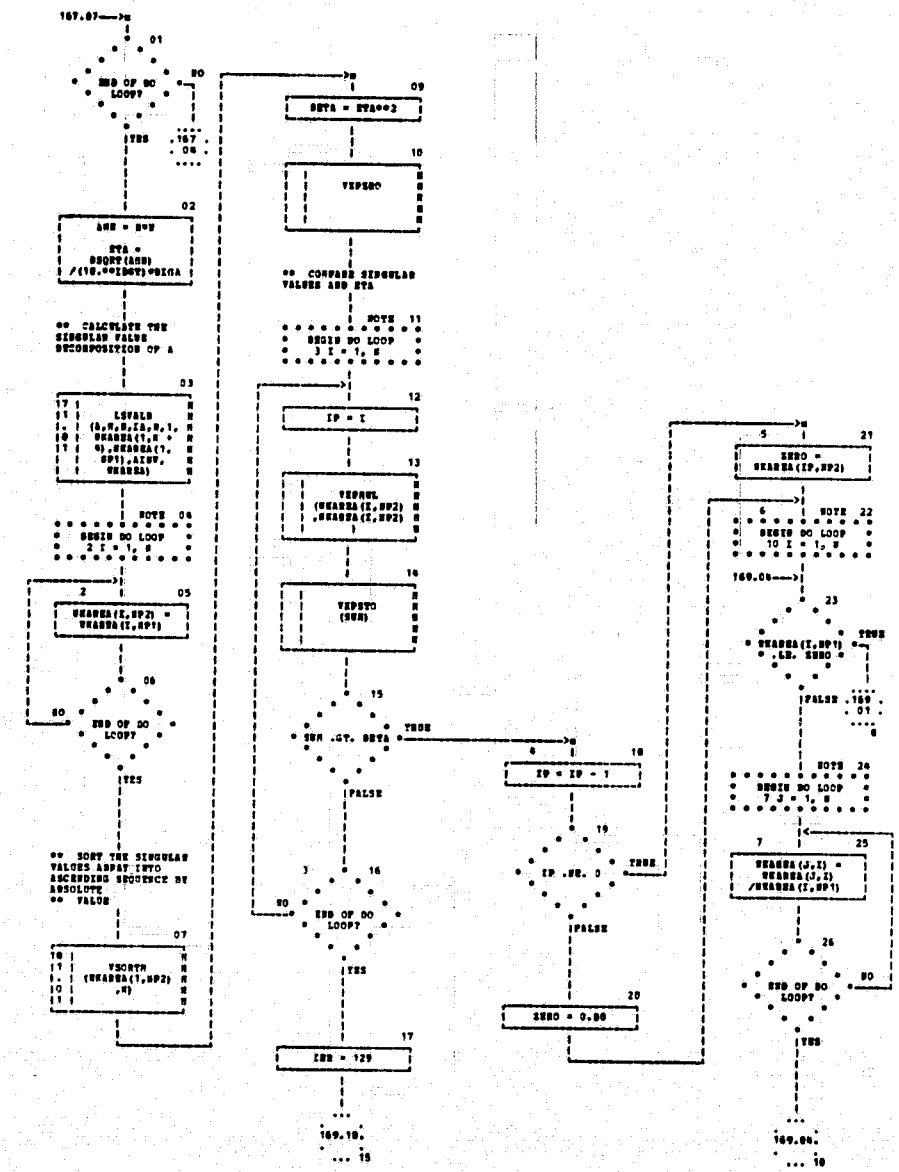


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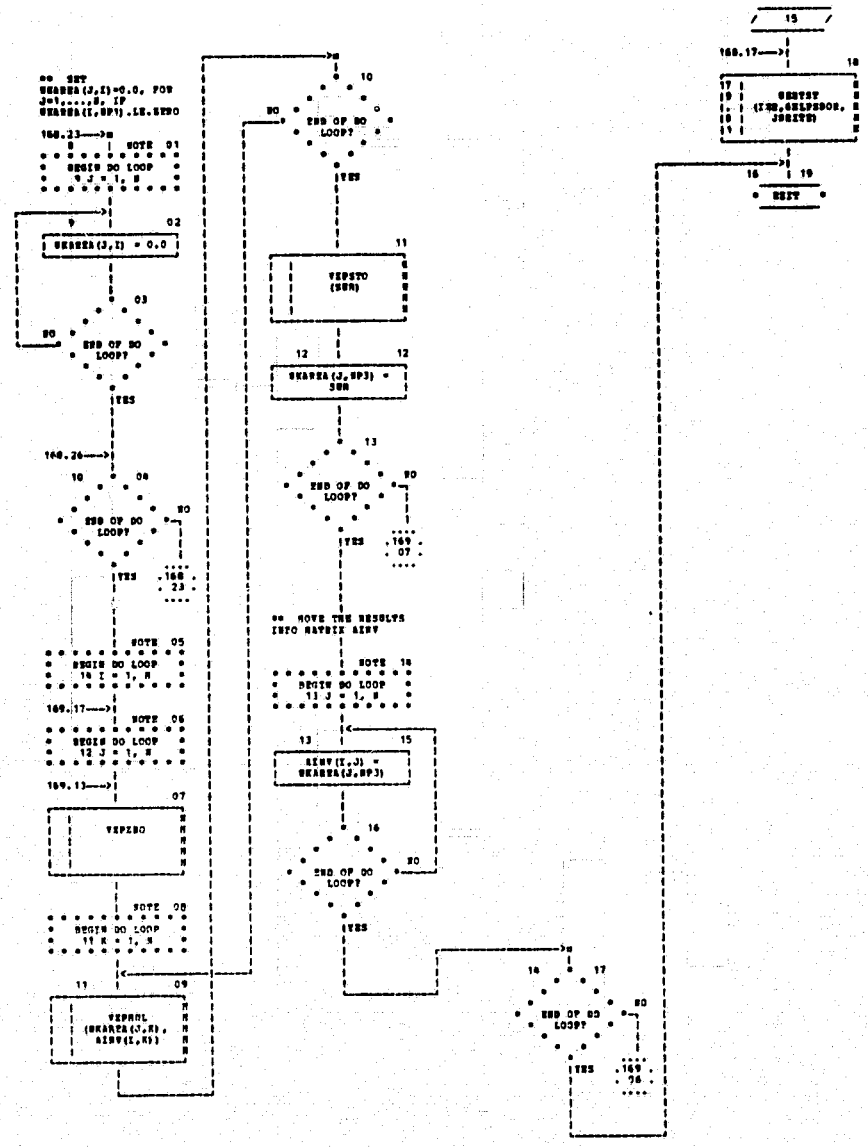
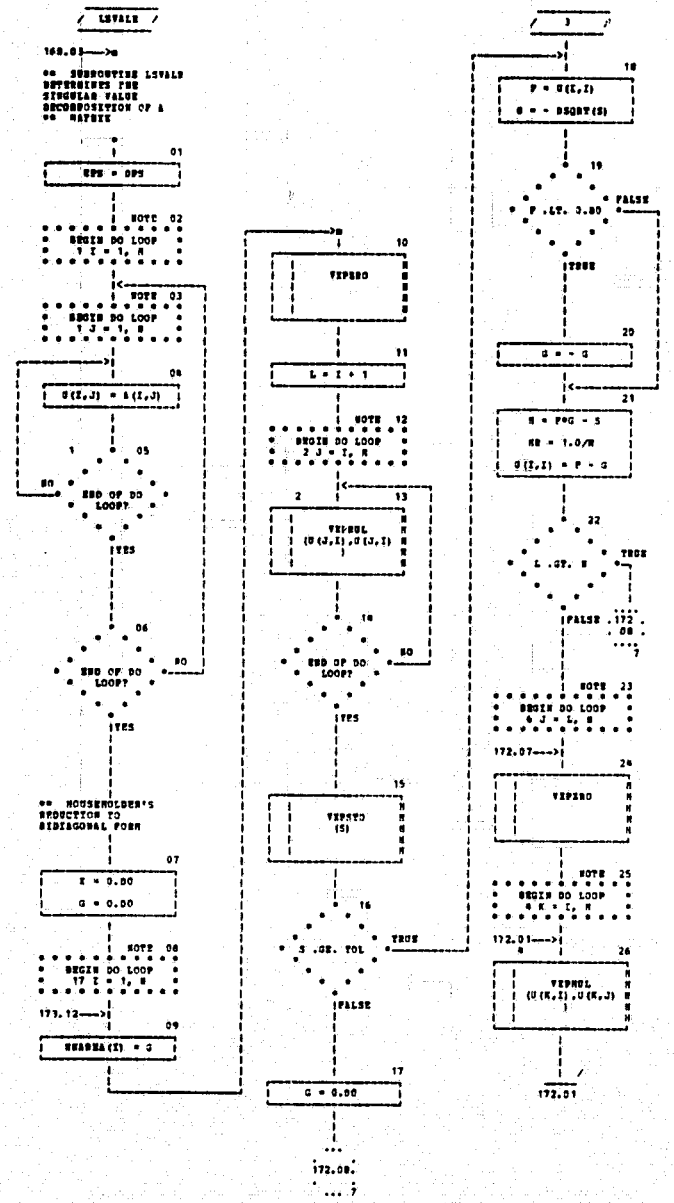


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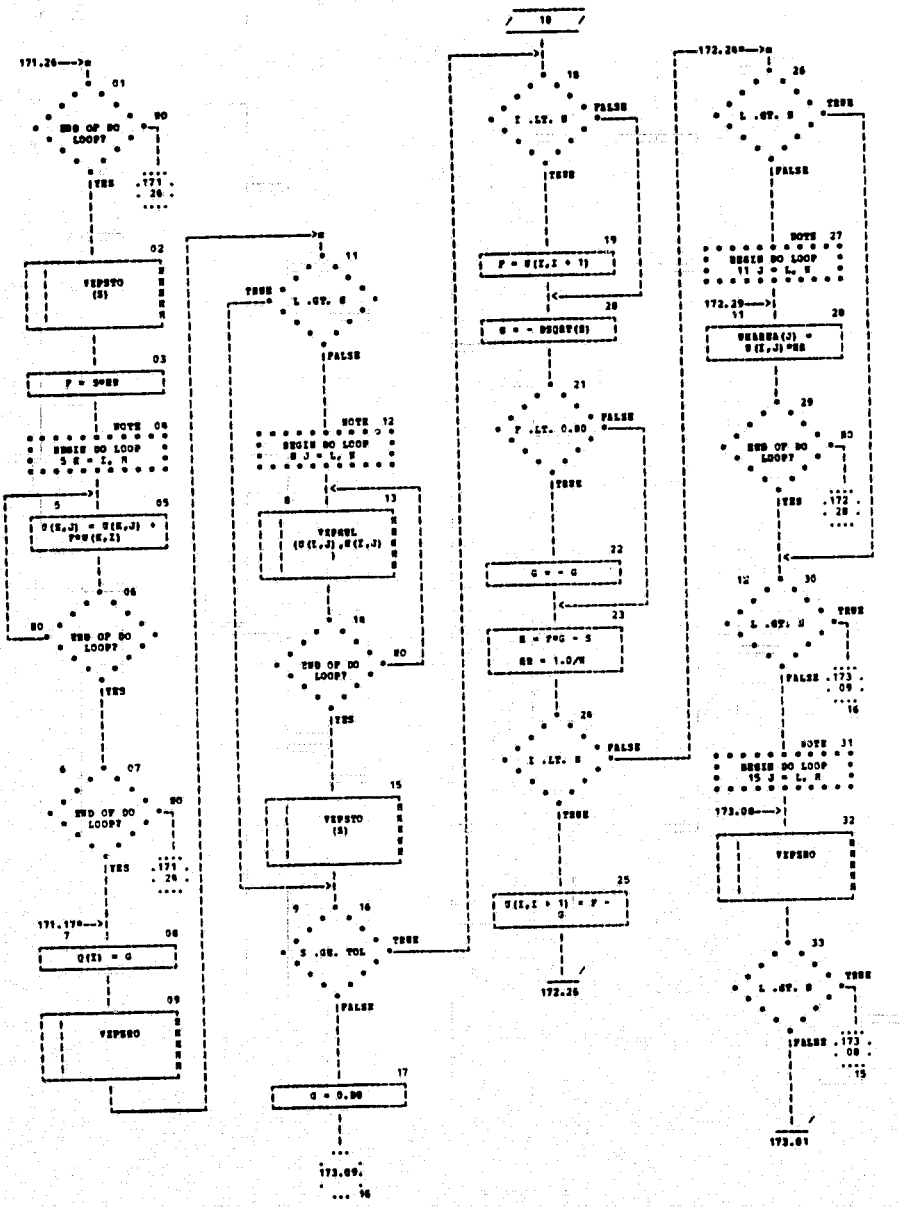
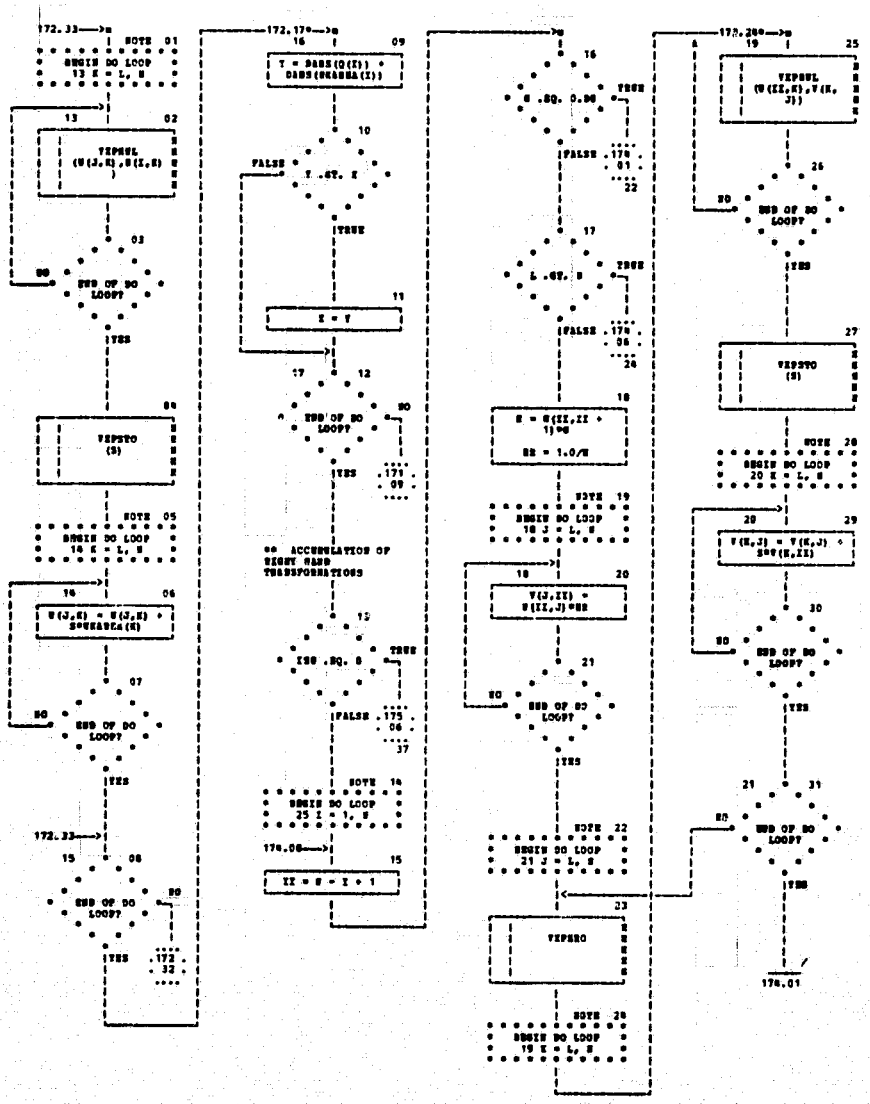


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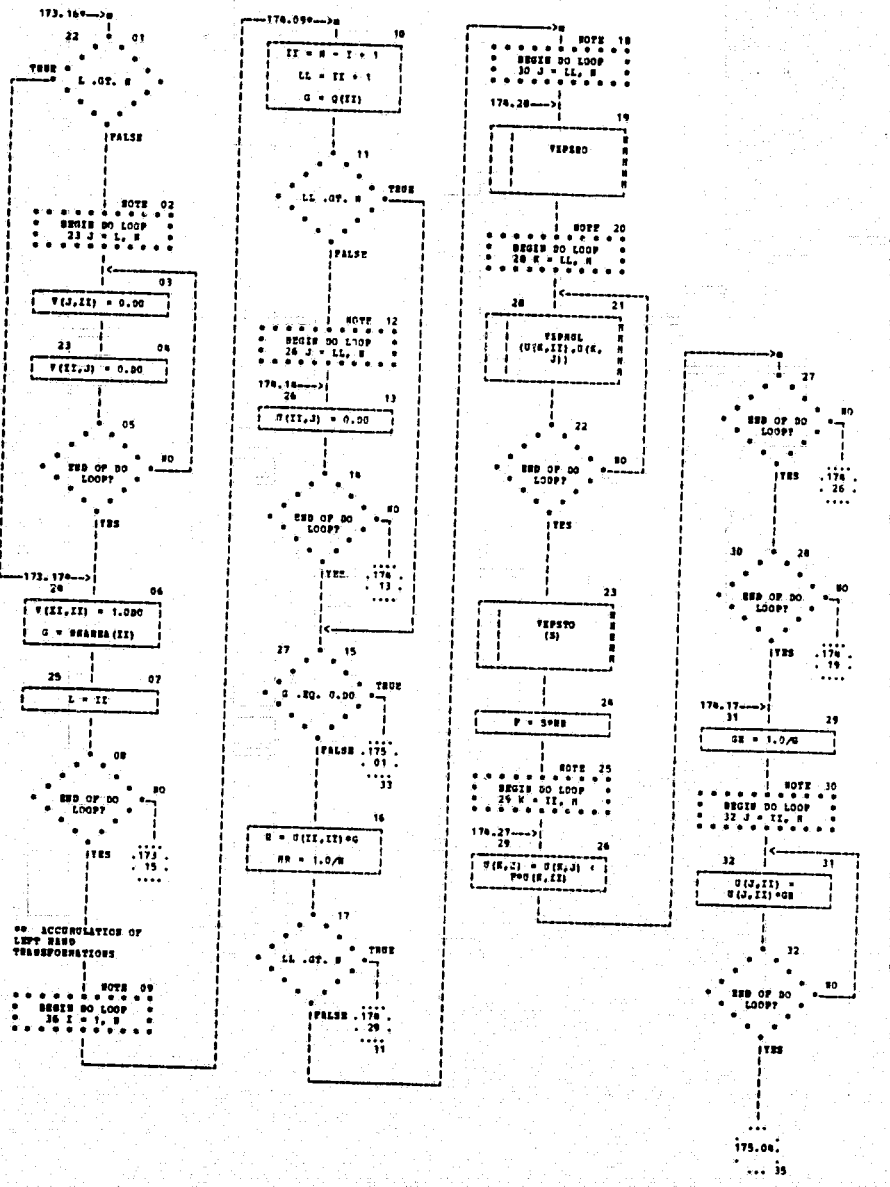


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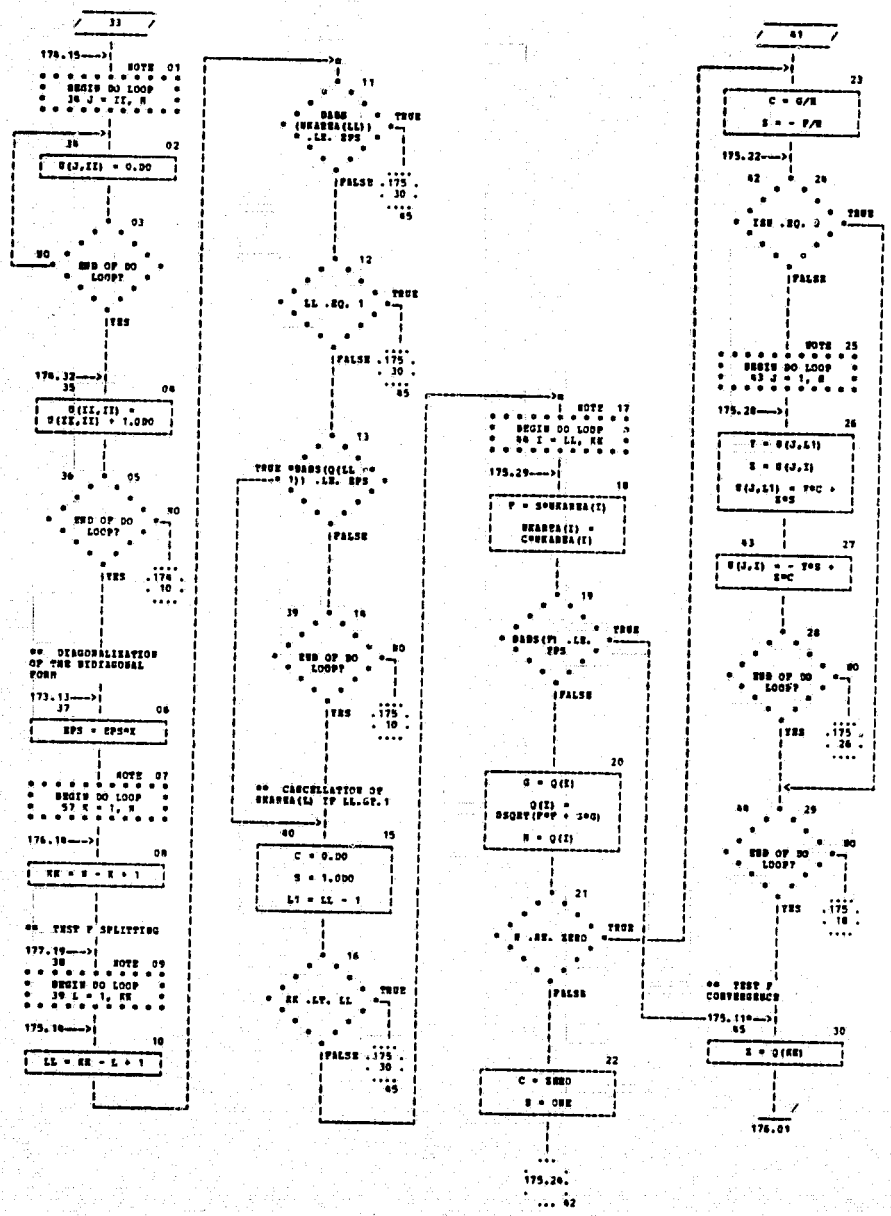


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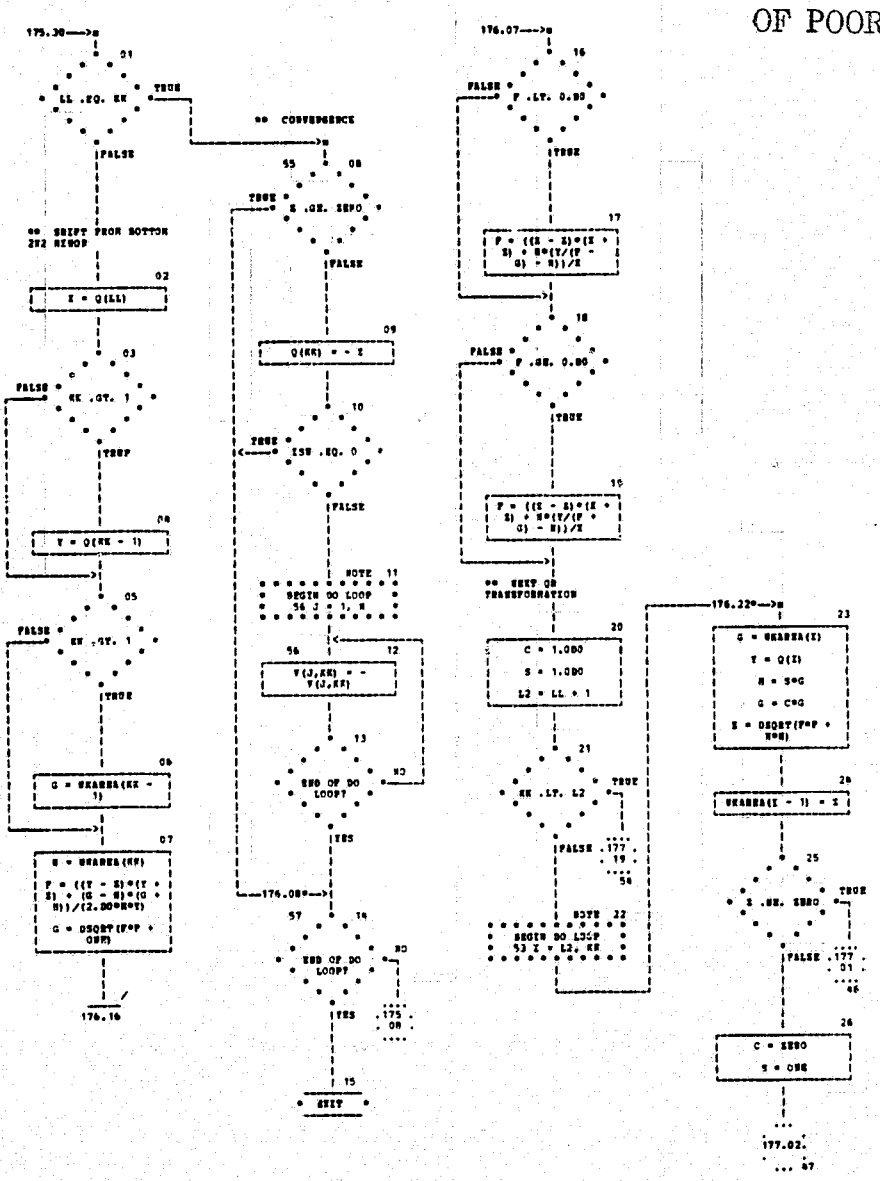


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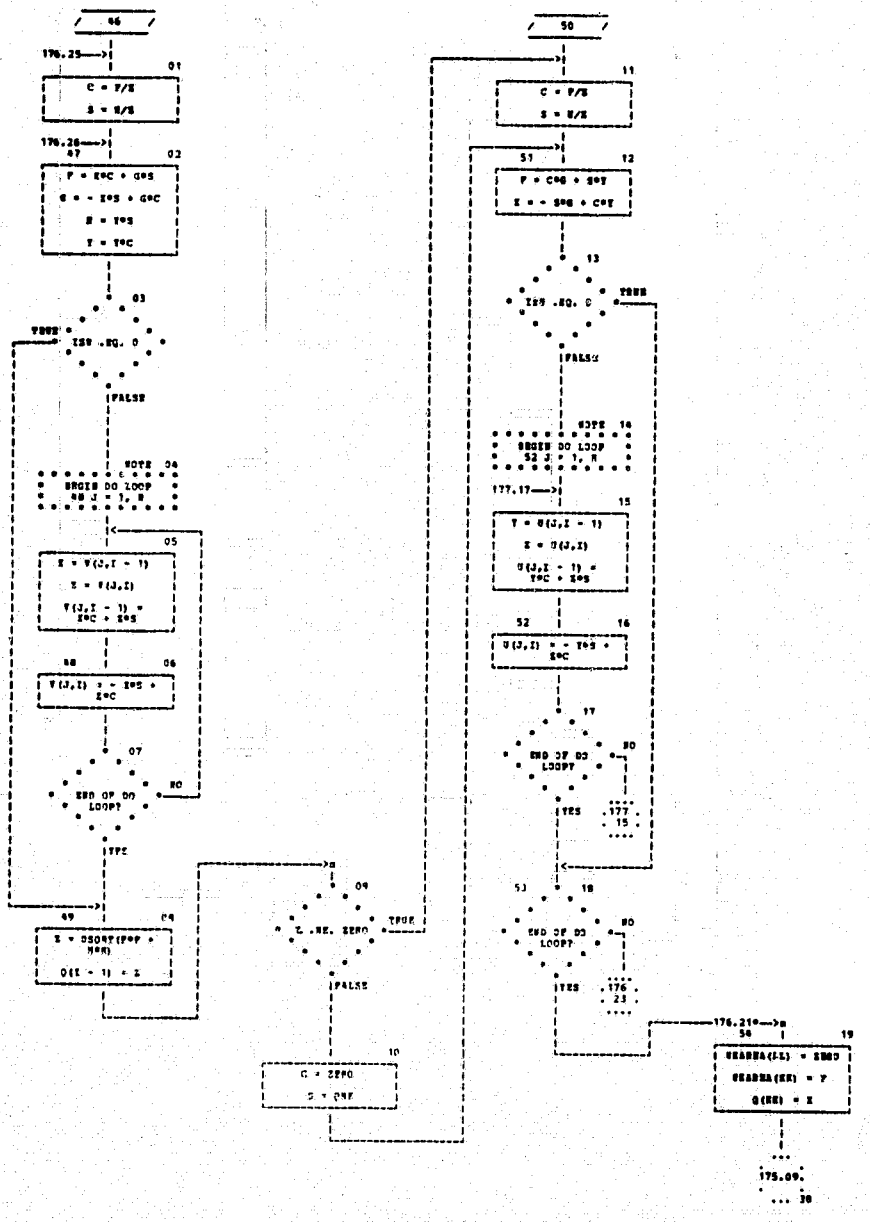


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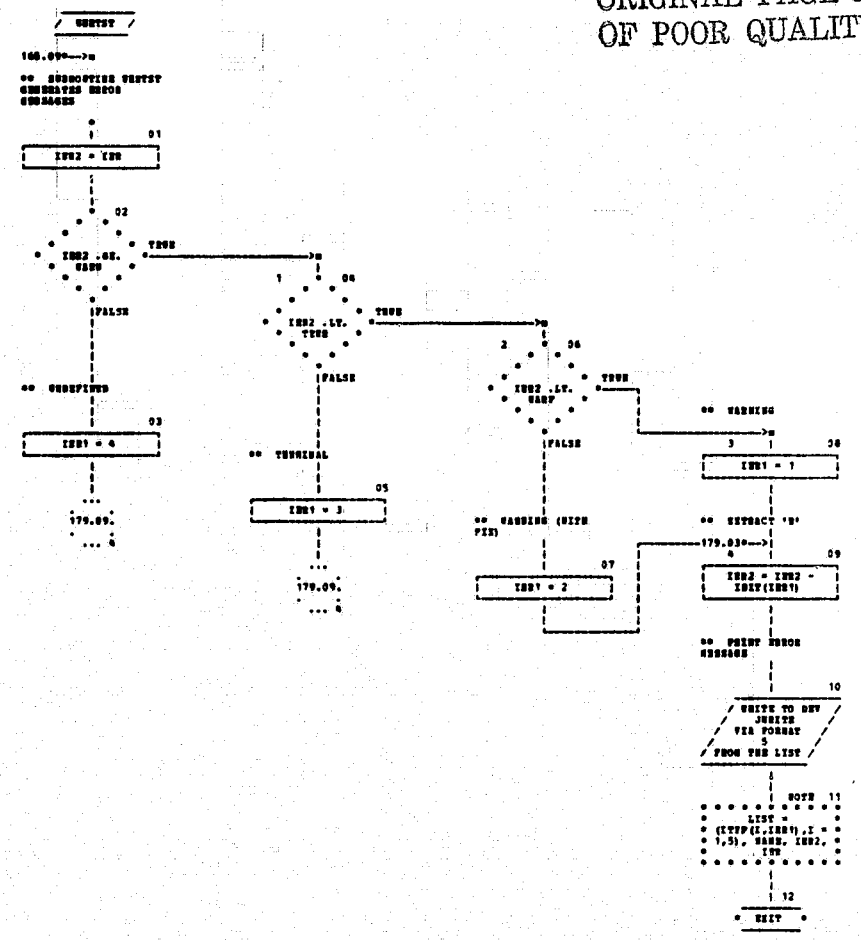


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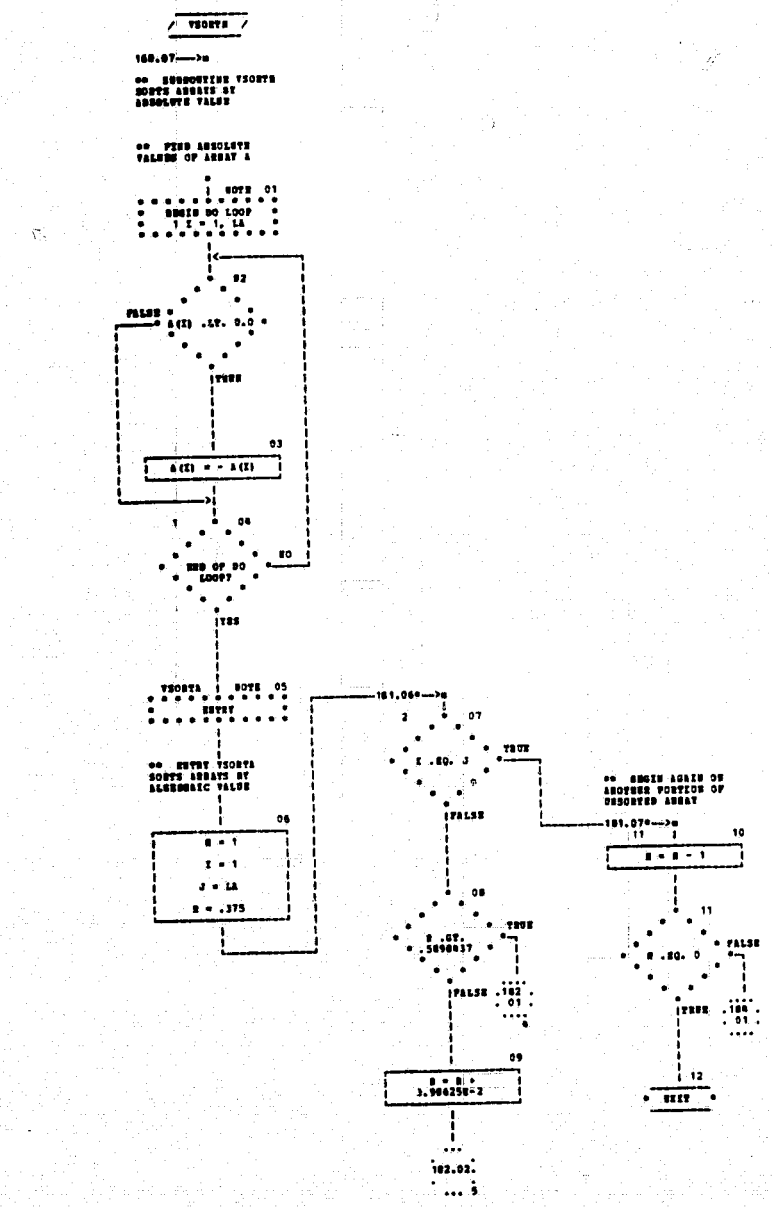
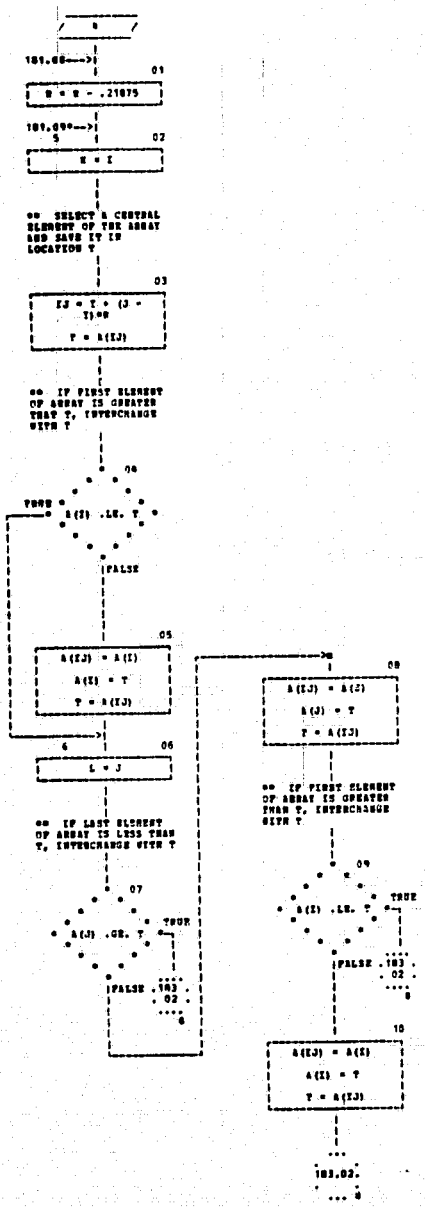


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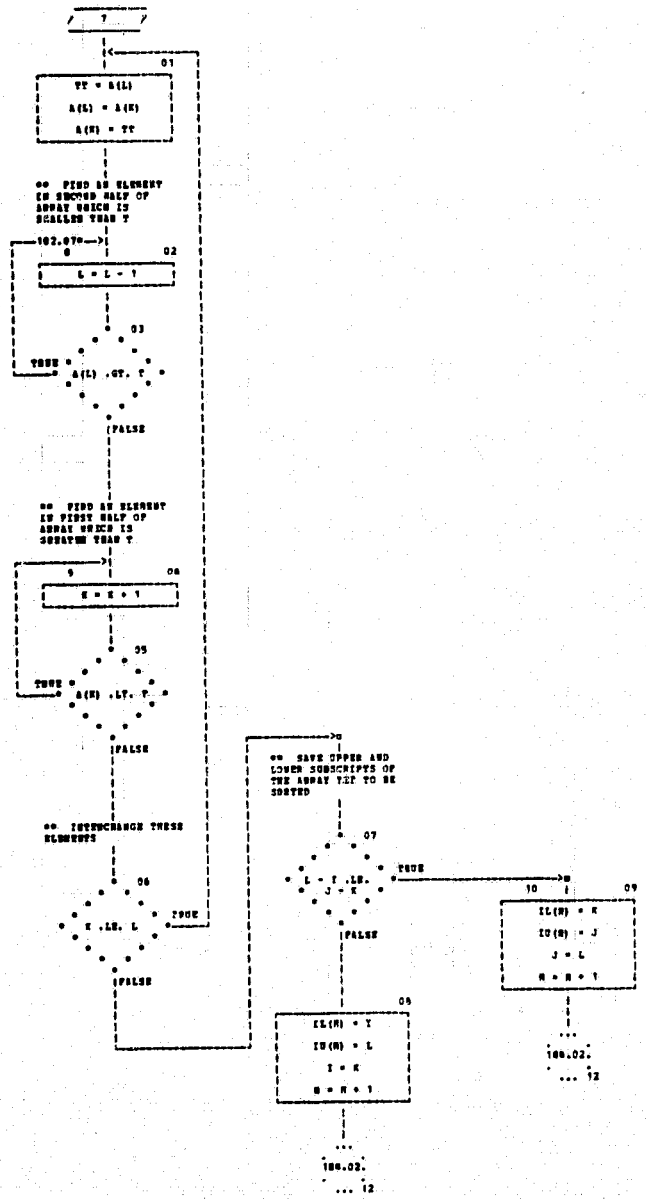
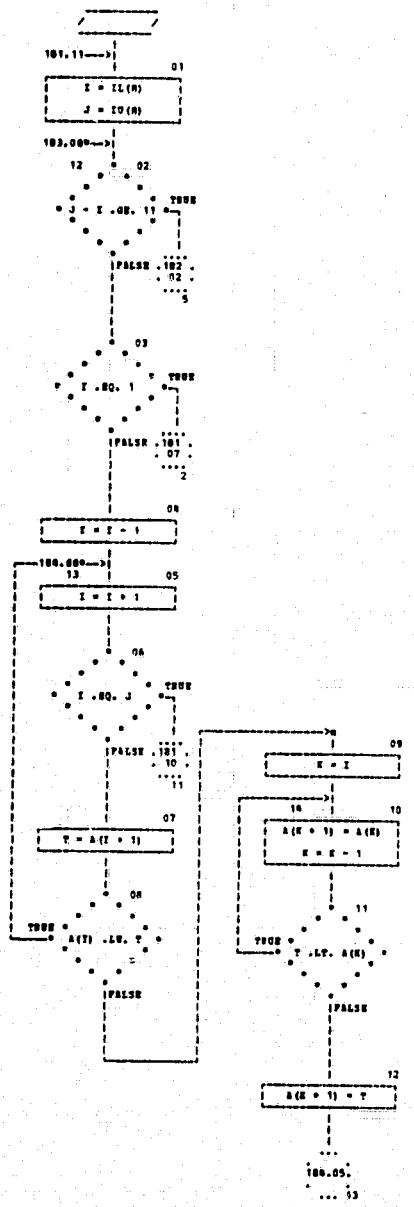
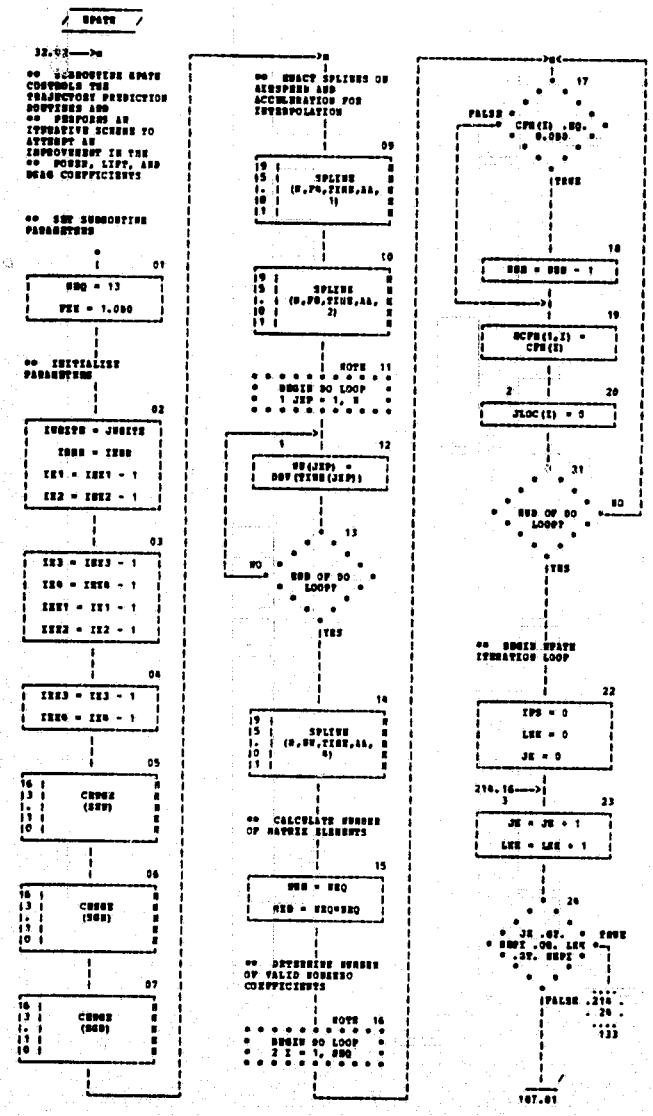


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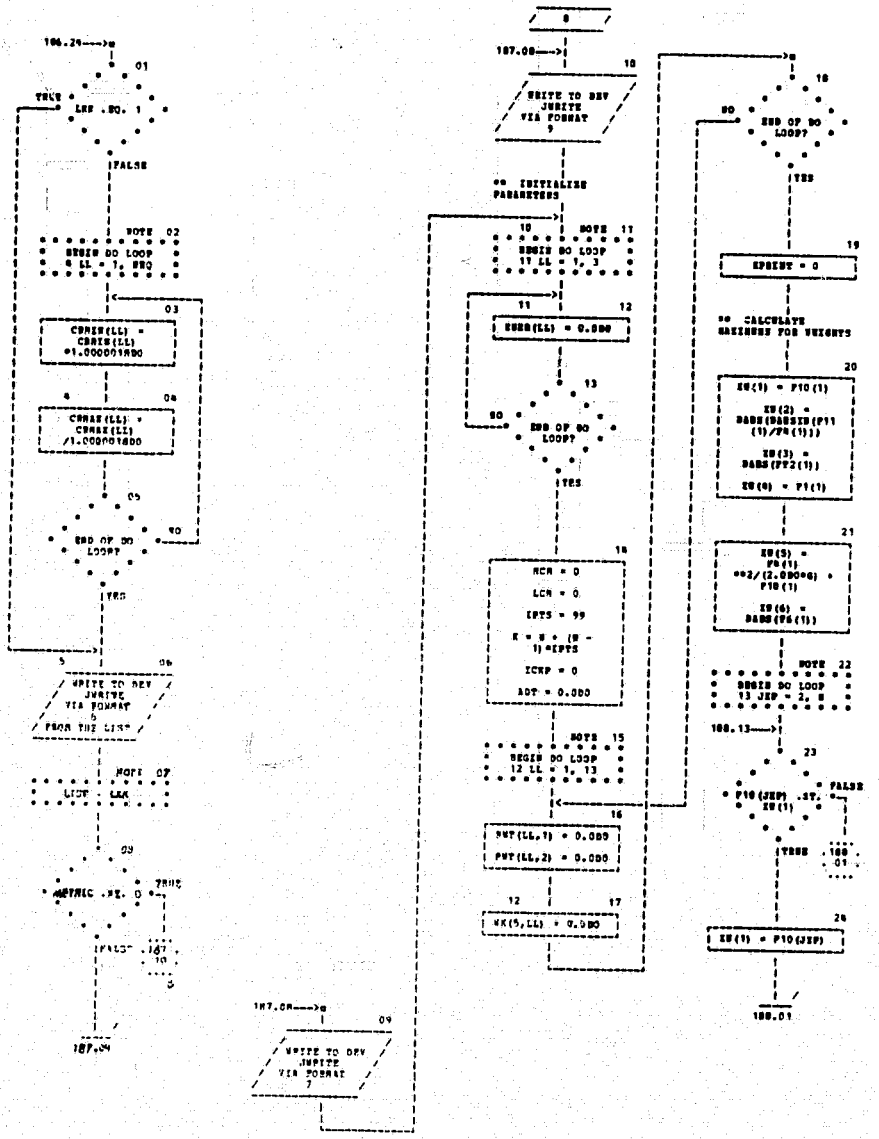
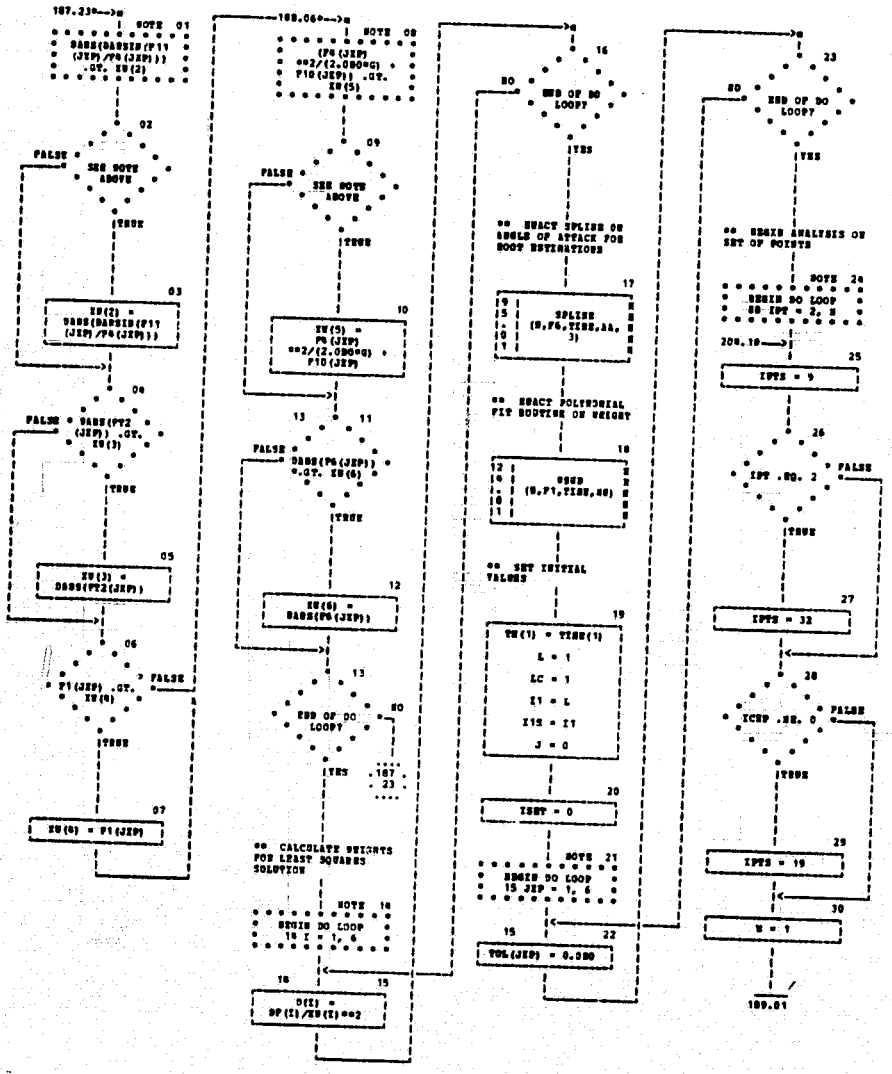
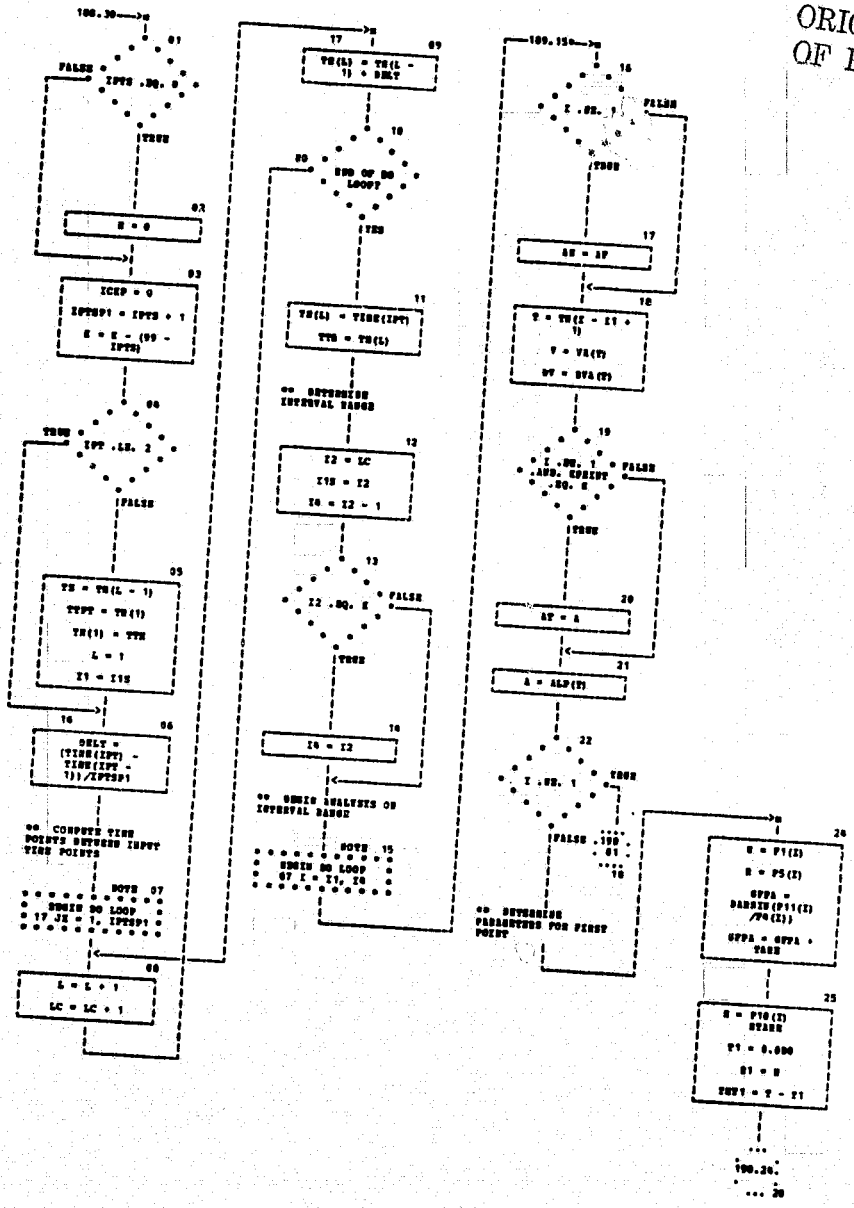


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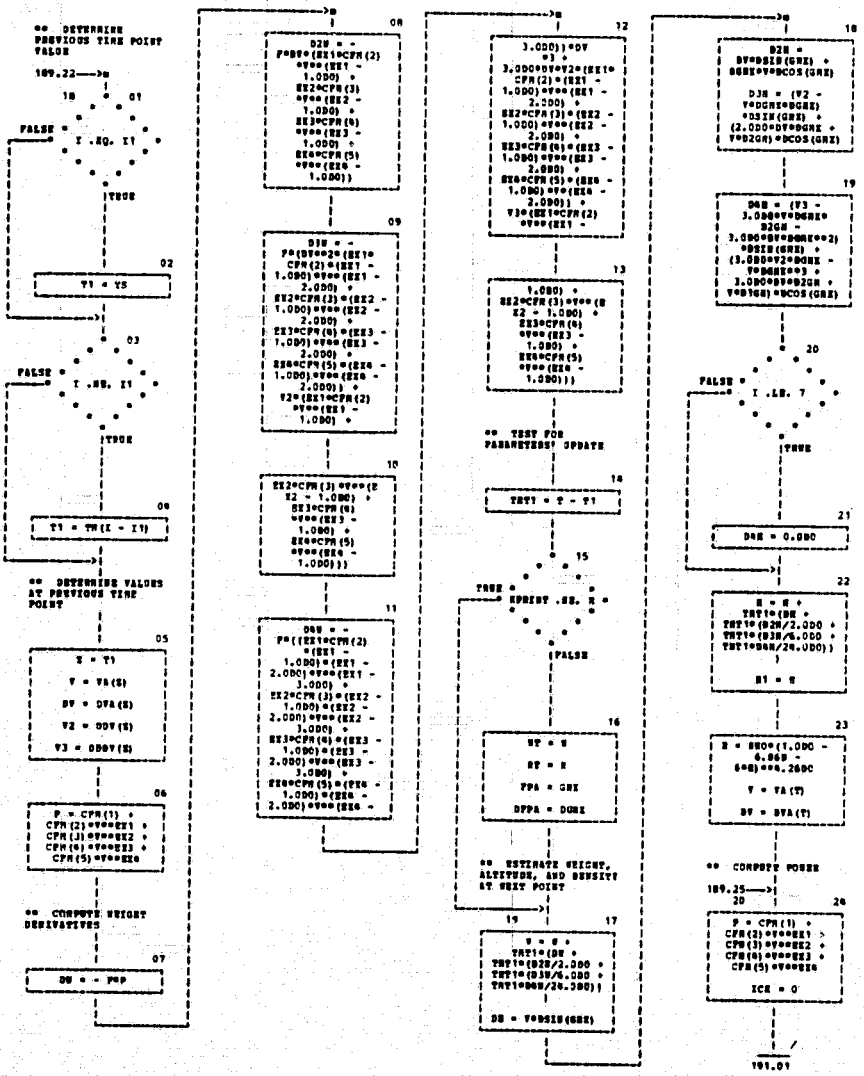


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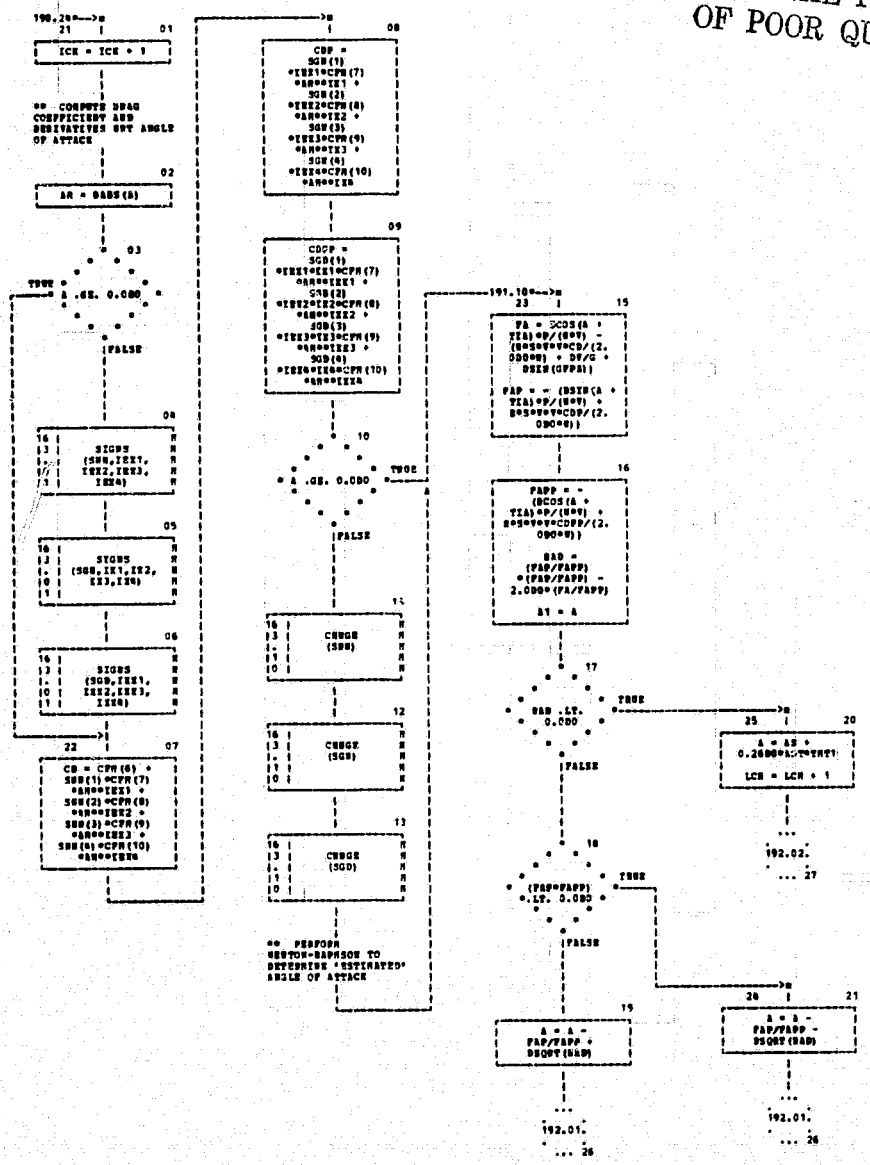
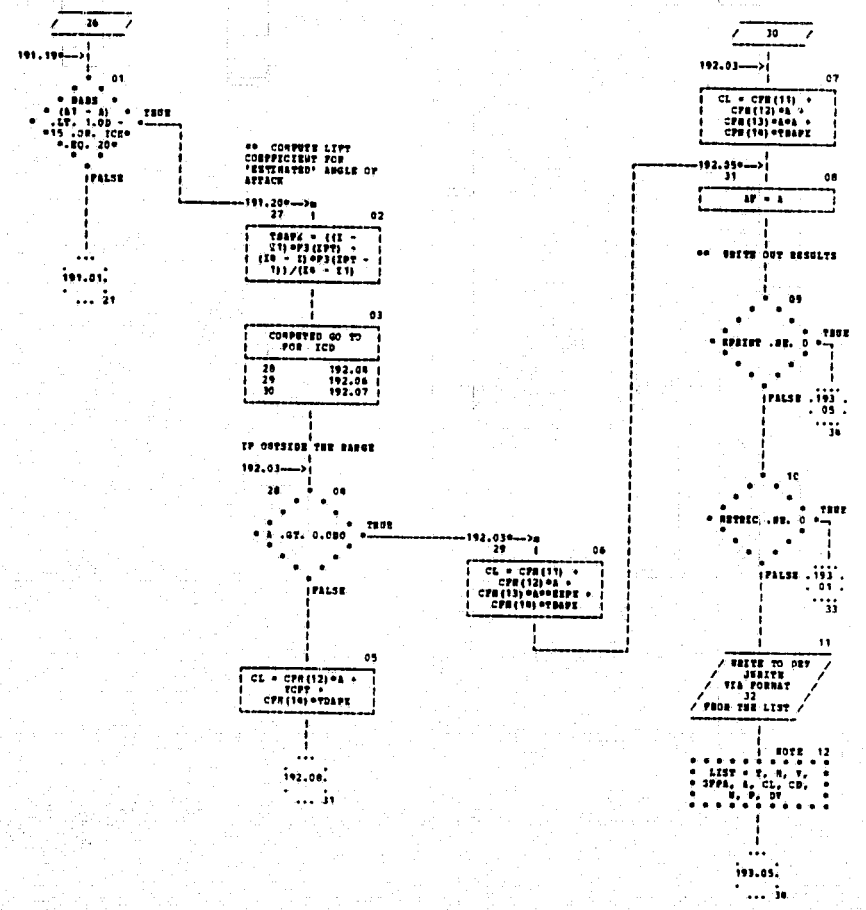


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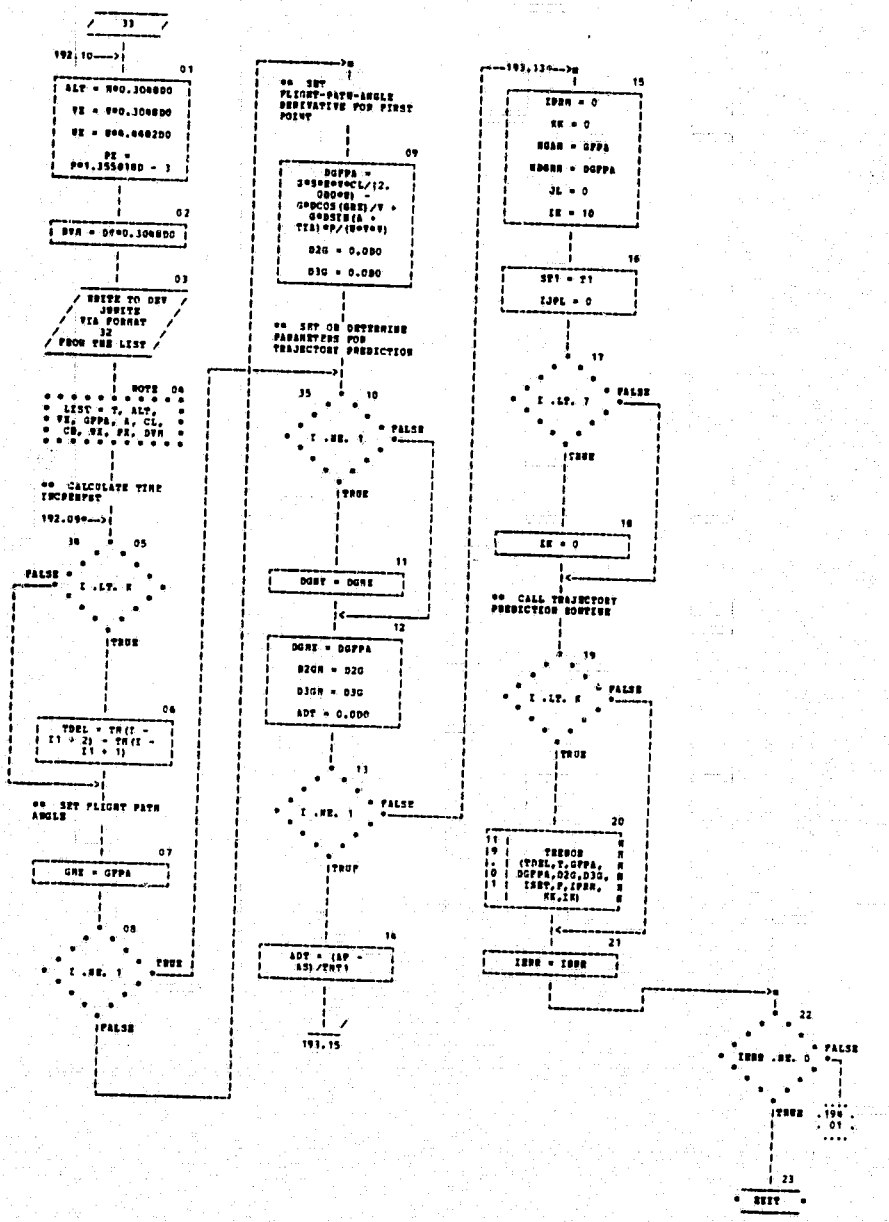
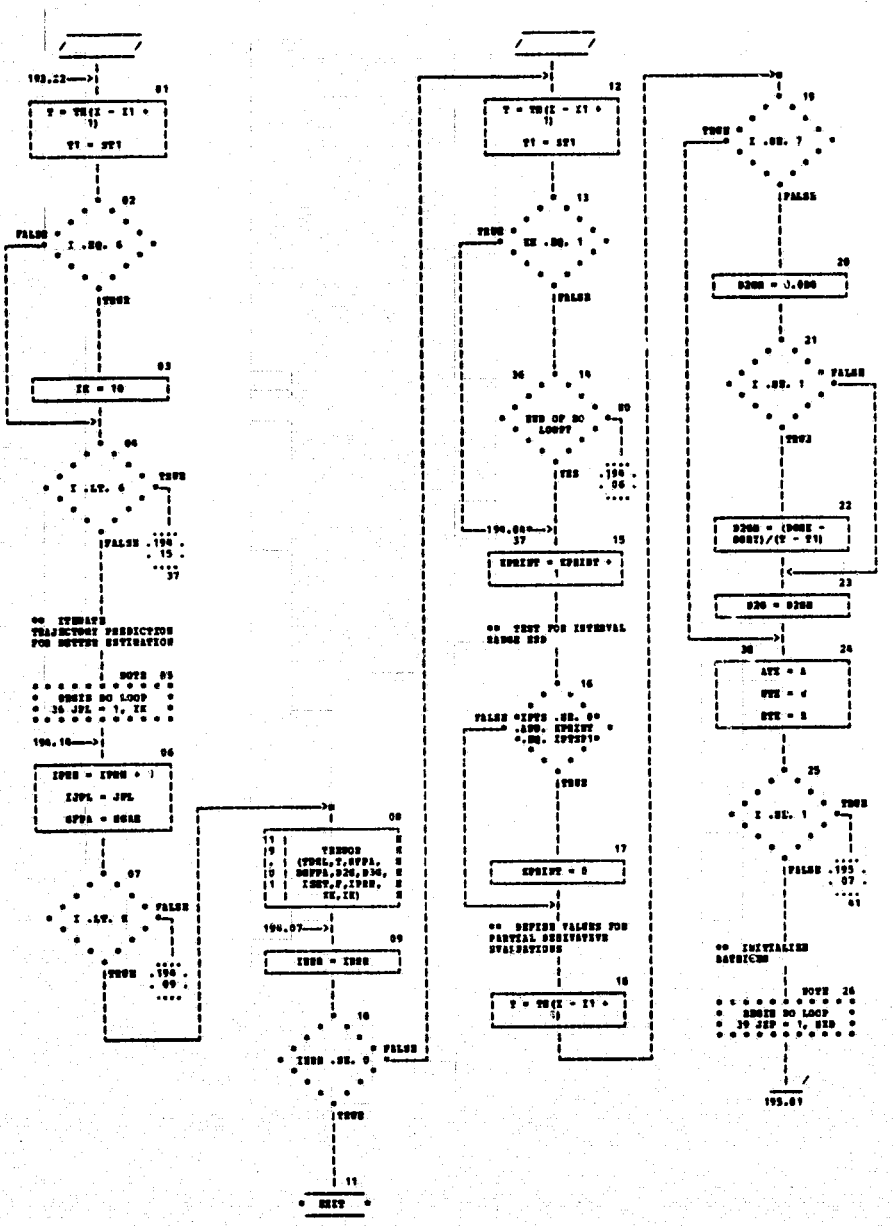


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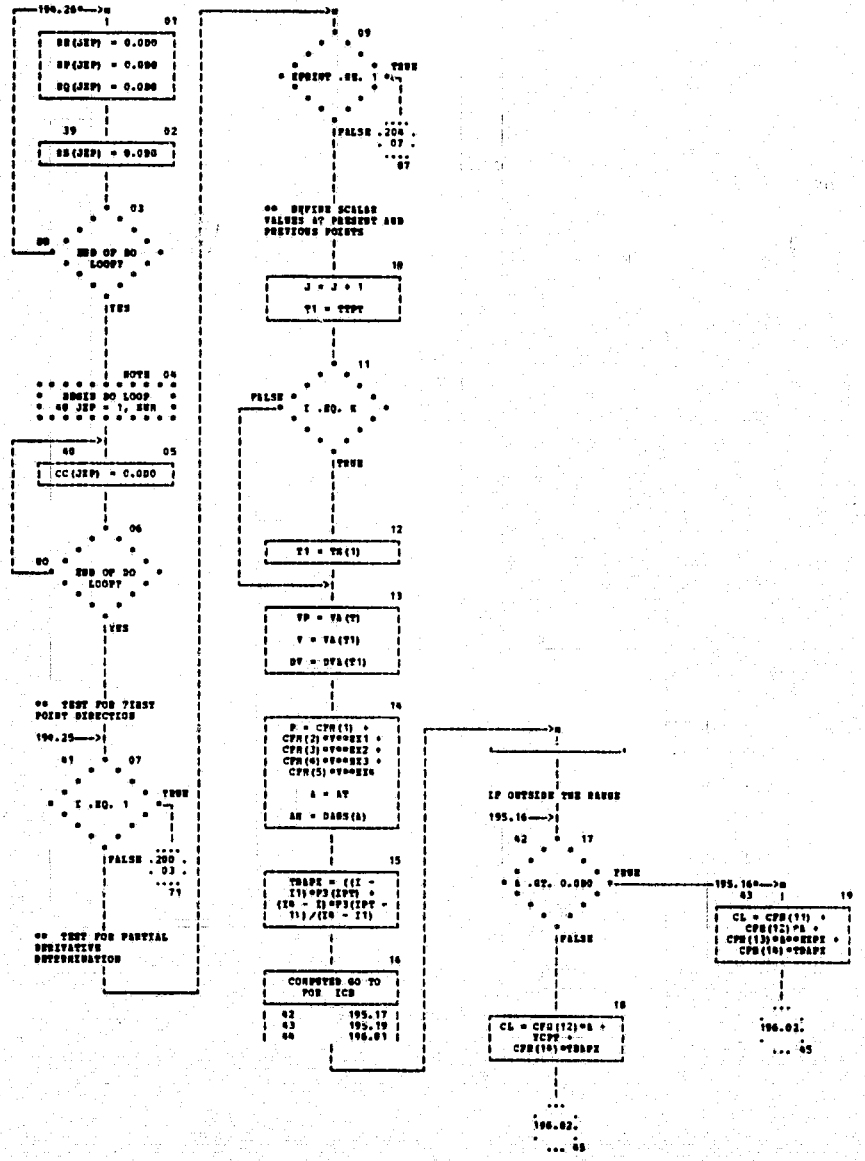
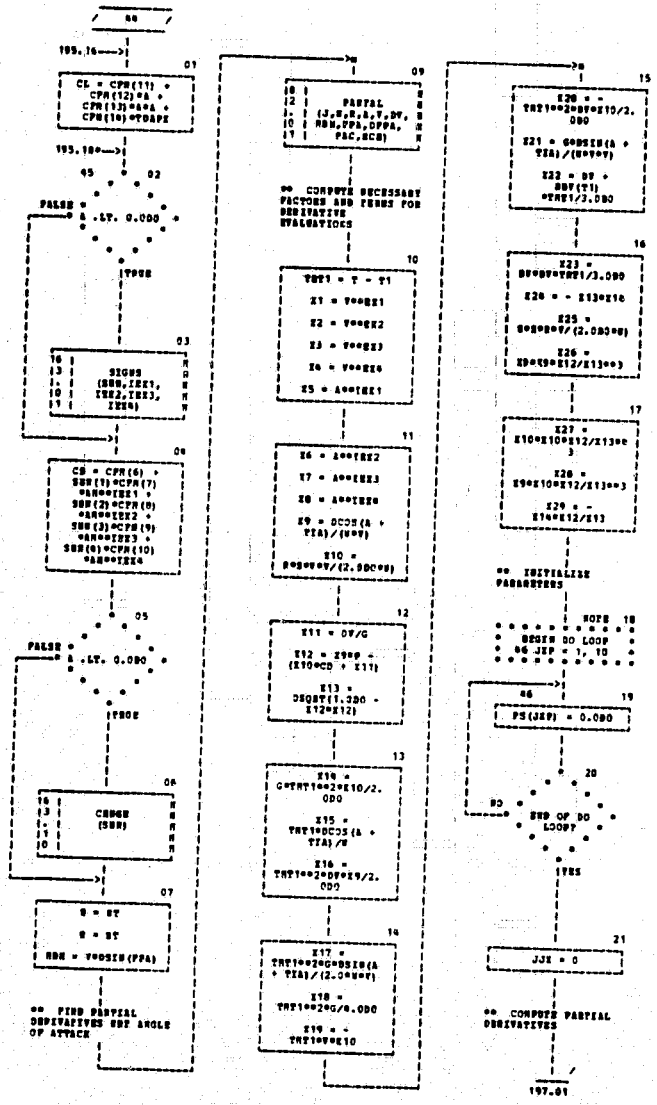


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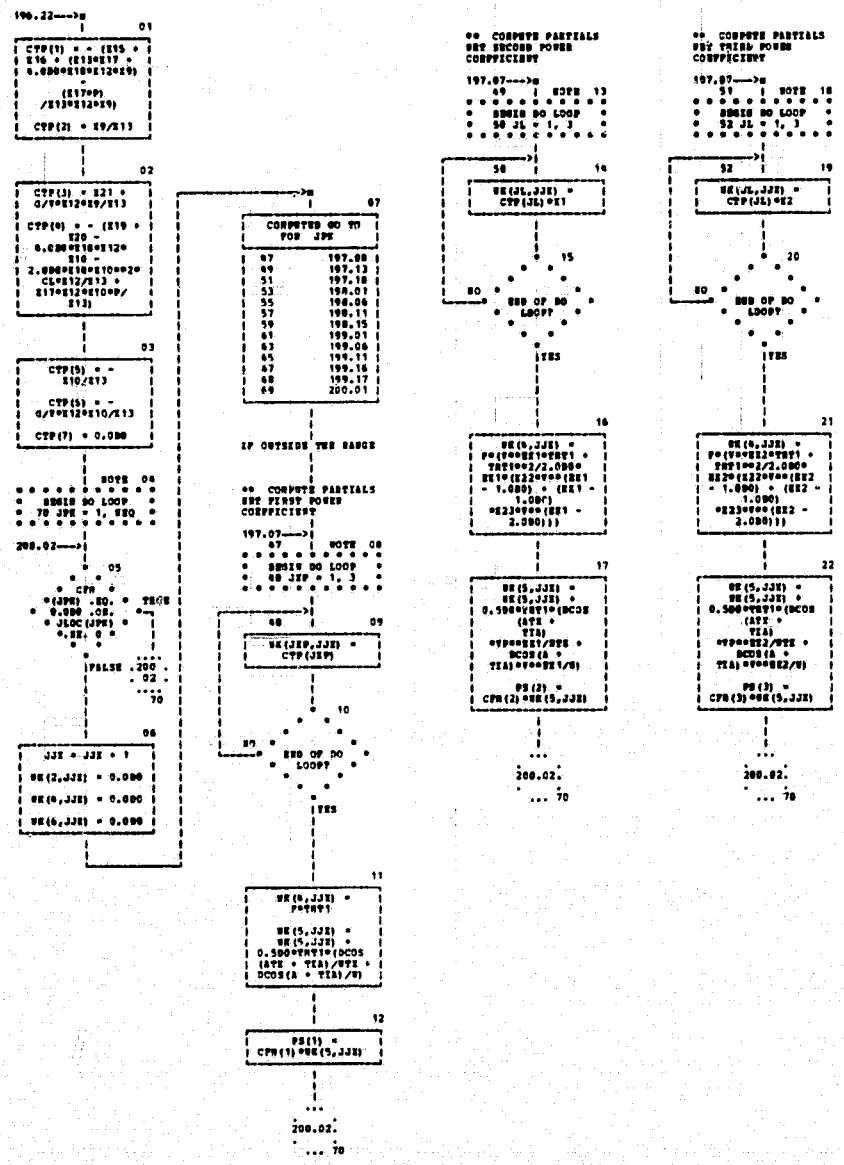
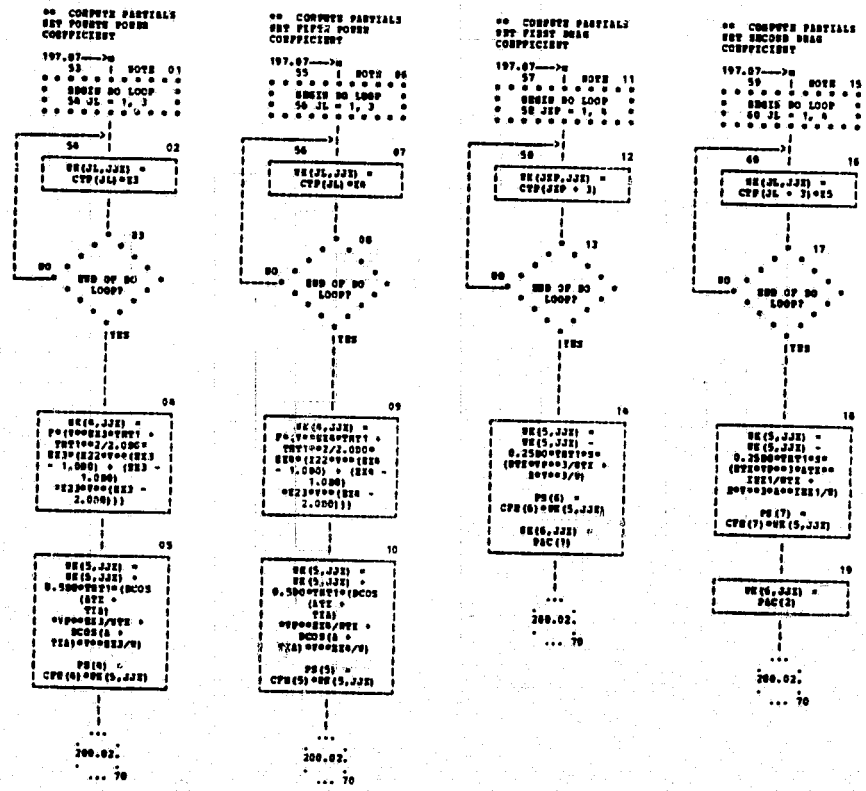


CHART TITLE - SUBROUTINE SPATS(N,P,BSB,LPBB,PIP,TABB,STABB,SWPI)



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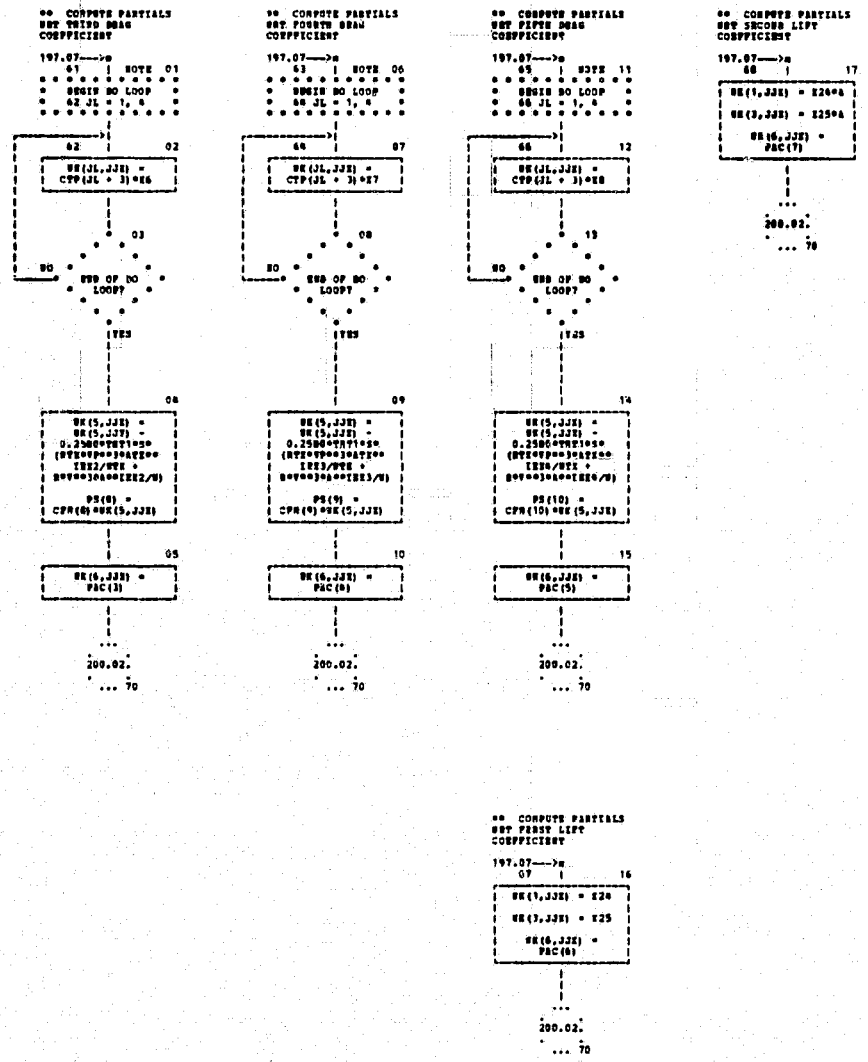
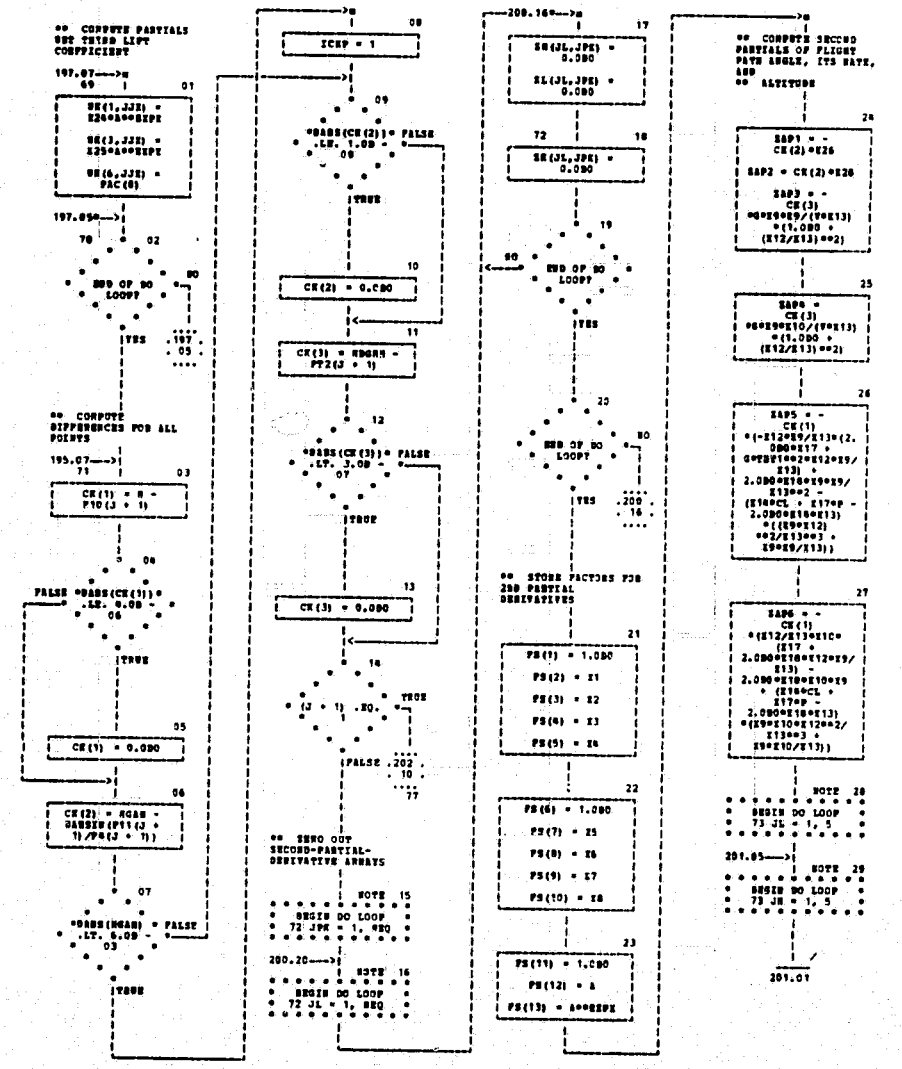


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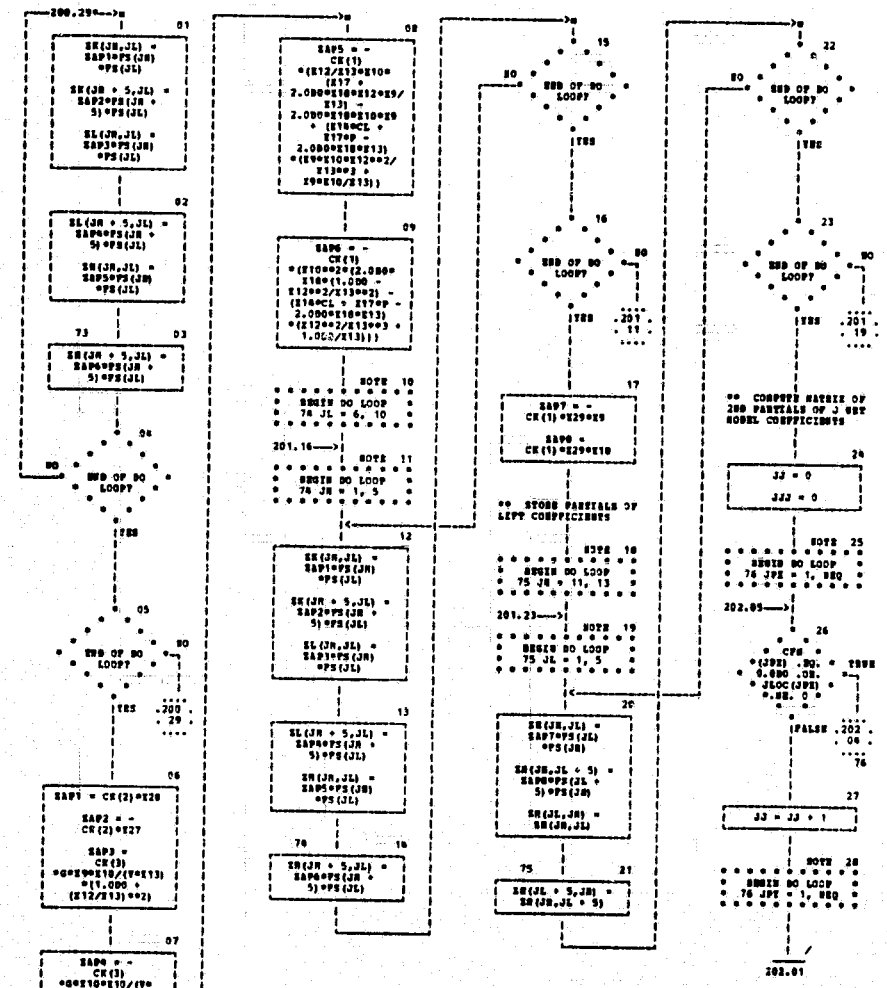
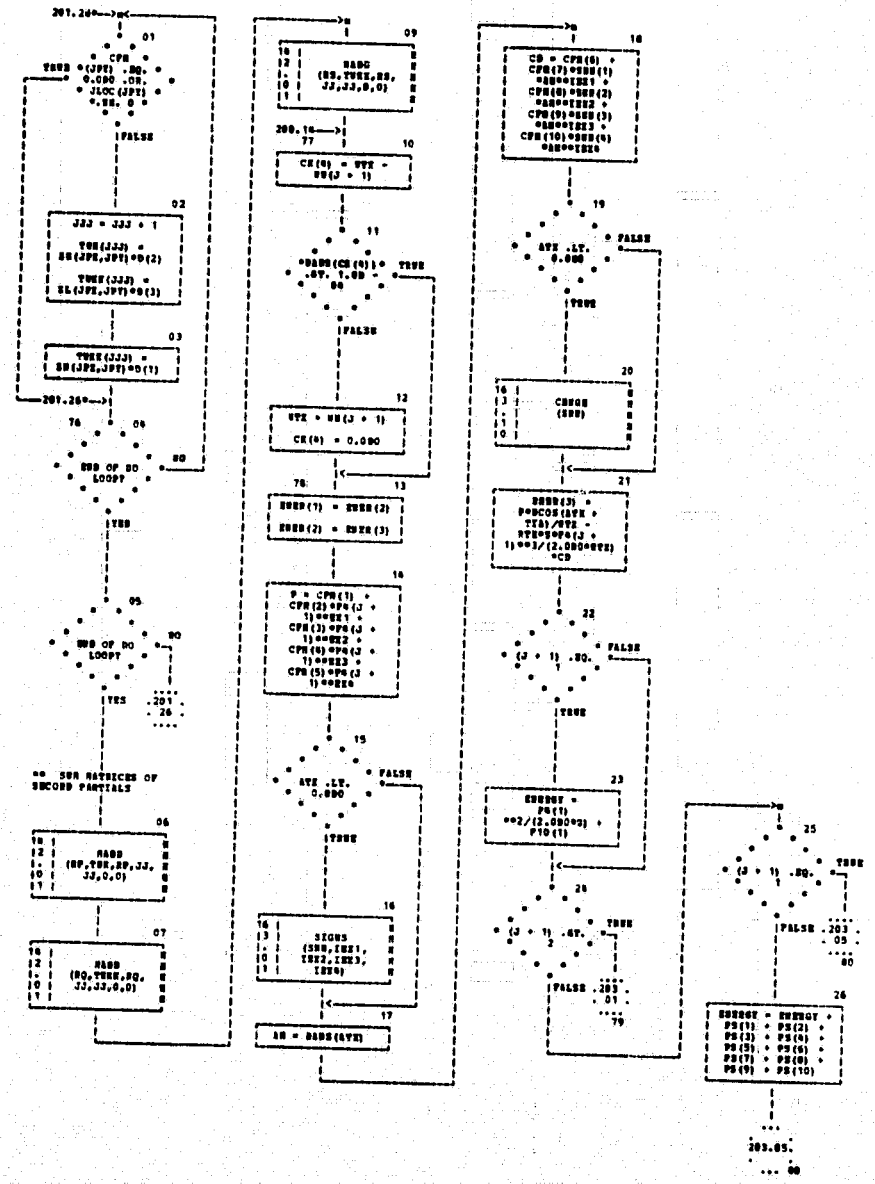


CHART TITLE - SUBROUTINE SPACE(N,P,RHO,LPRG,PIP,TAUS,BTAUS,BSPI)



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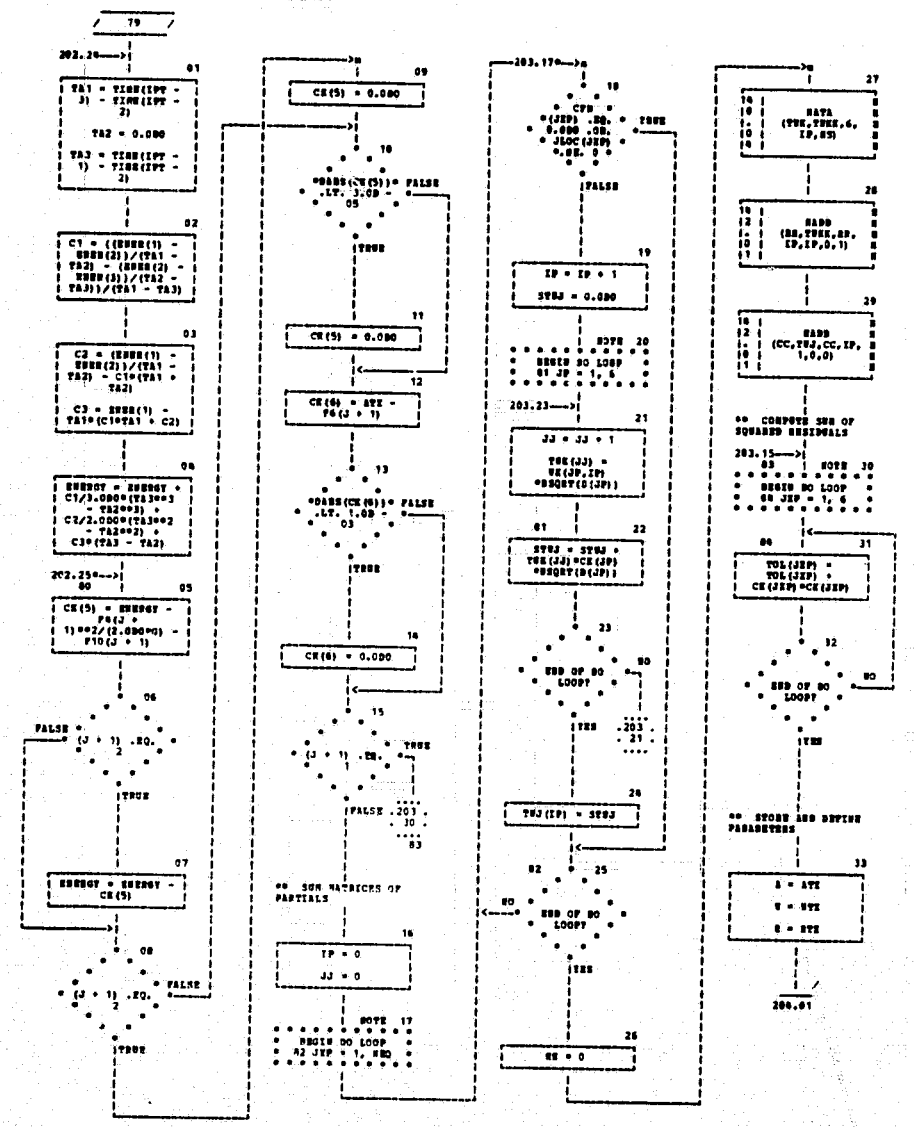
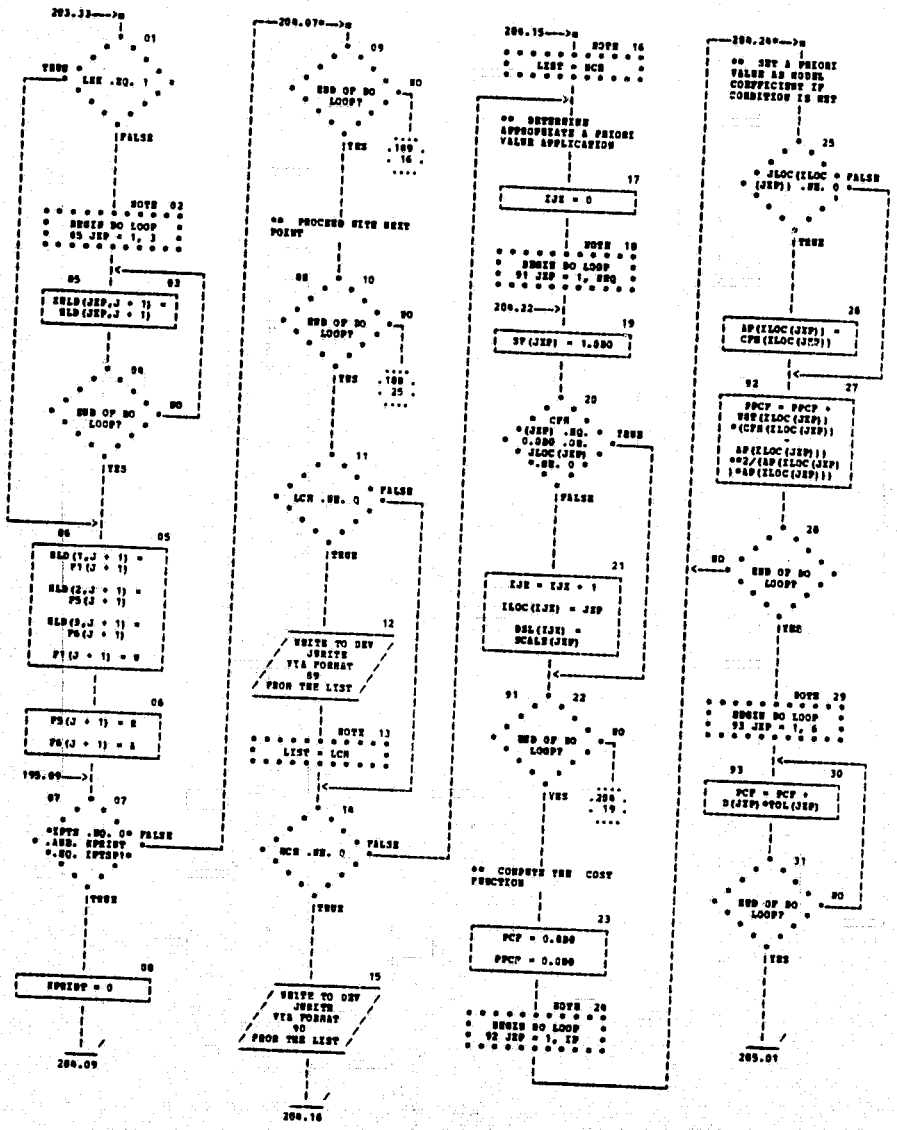


CHART TITLE - SUBROUTINE GPAPS(N,P,SSS,LPSS,PIP,TSSS,STSSS,SSPI)



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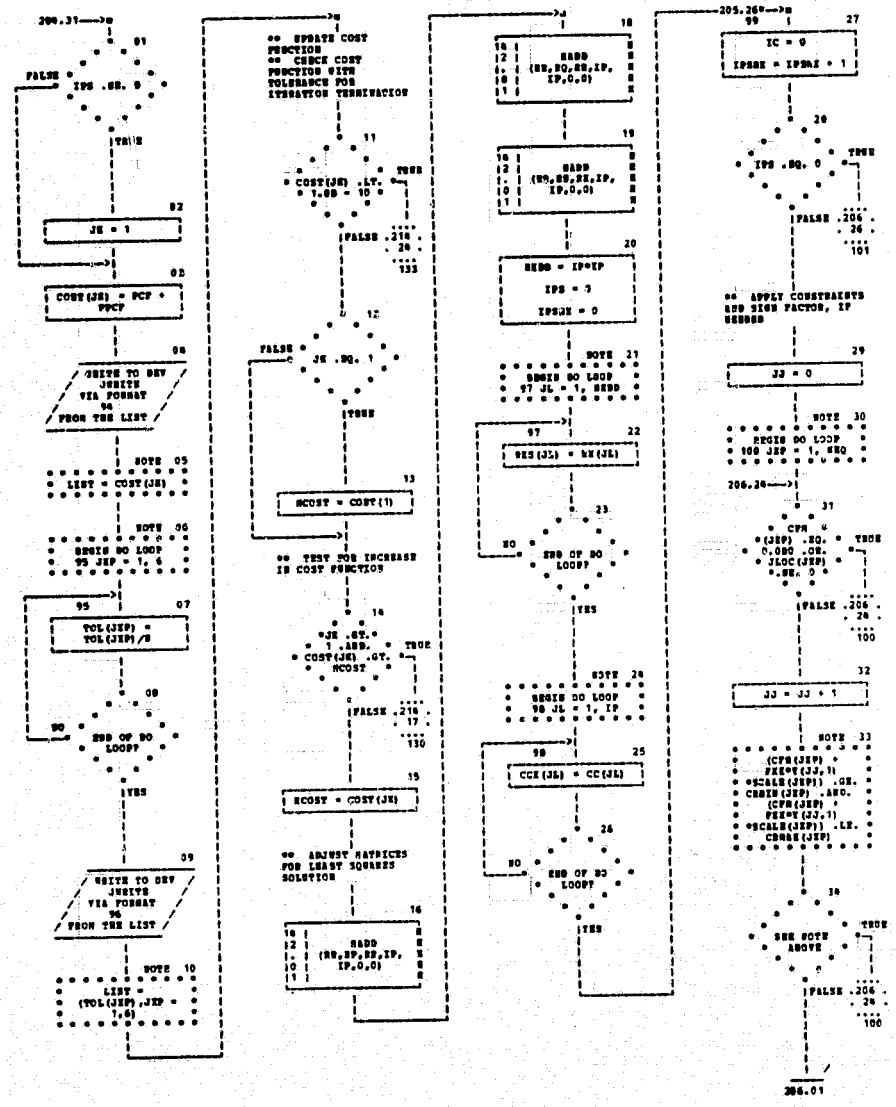
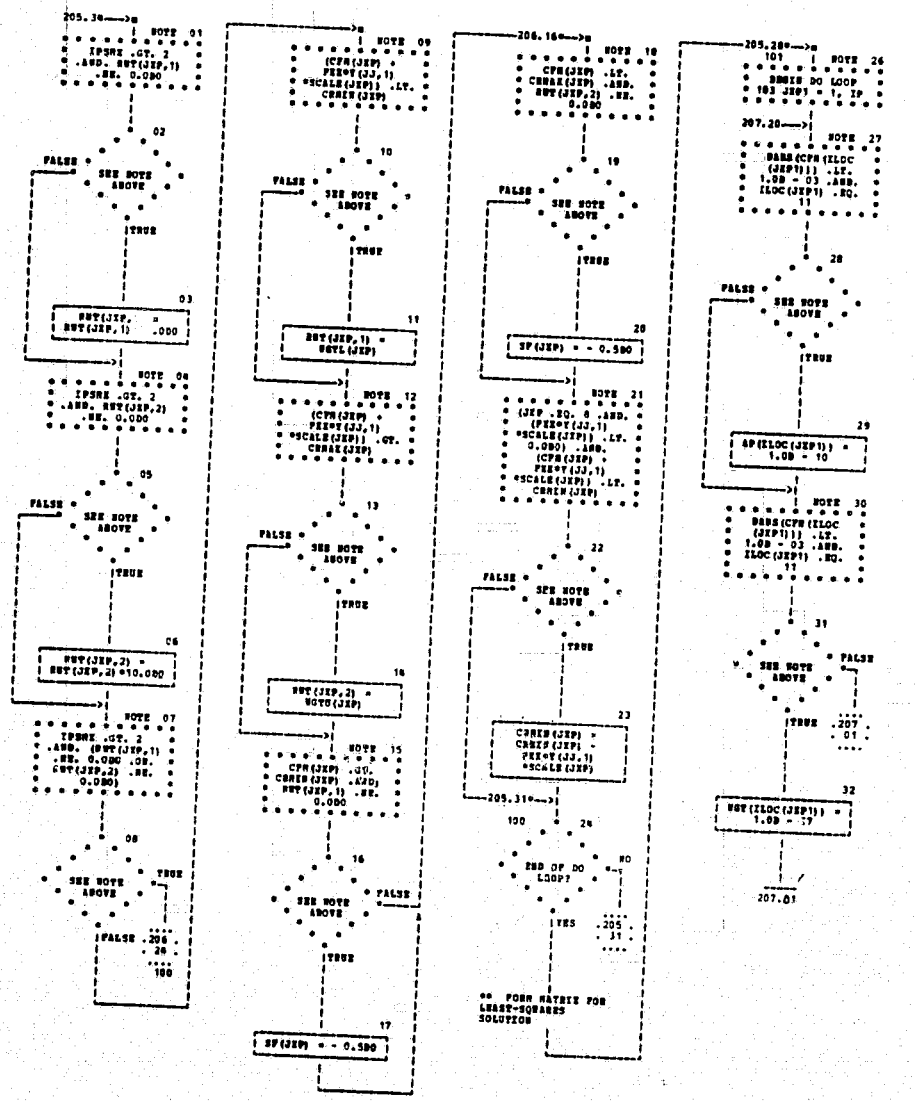


CHART TITLE - SUBROUTINE SPSTR(S,F,NSB,LPBS,PST,TABS,STARS,SSPI)



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CHART TITLE - SUBROUTINE SPATH(N,F,RES,LPNO,PIV,TABX,UTABX,UBPX)

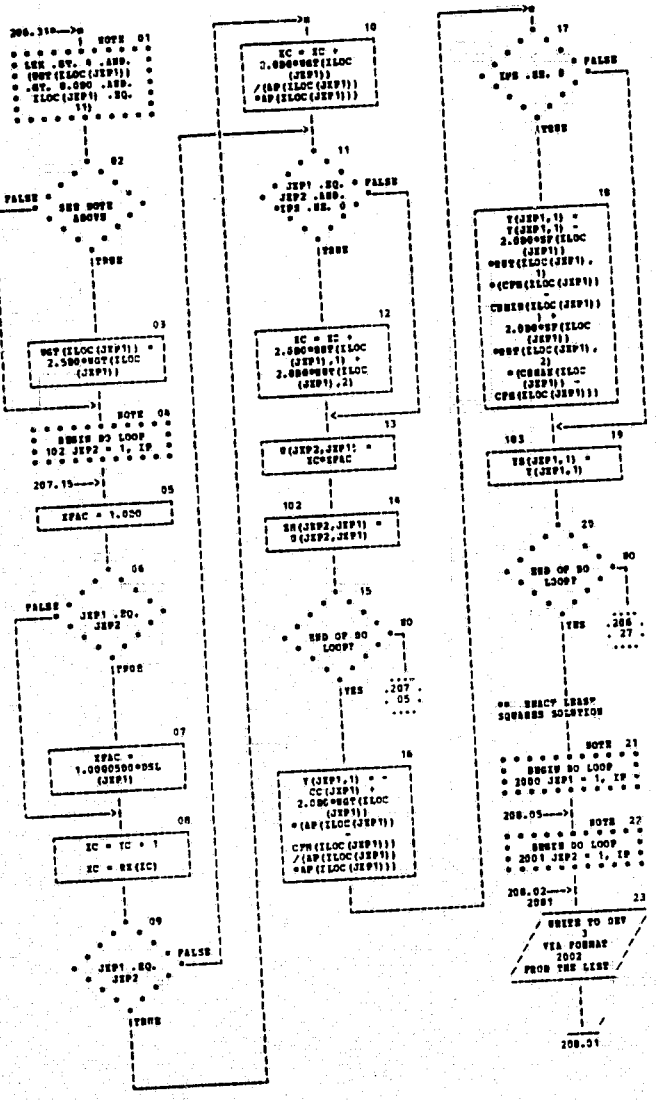
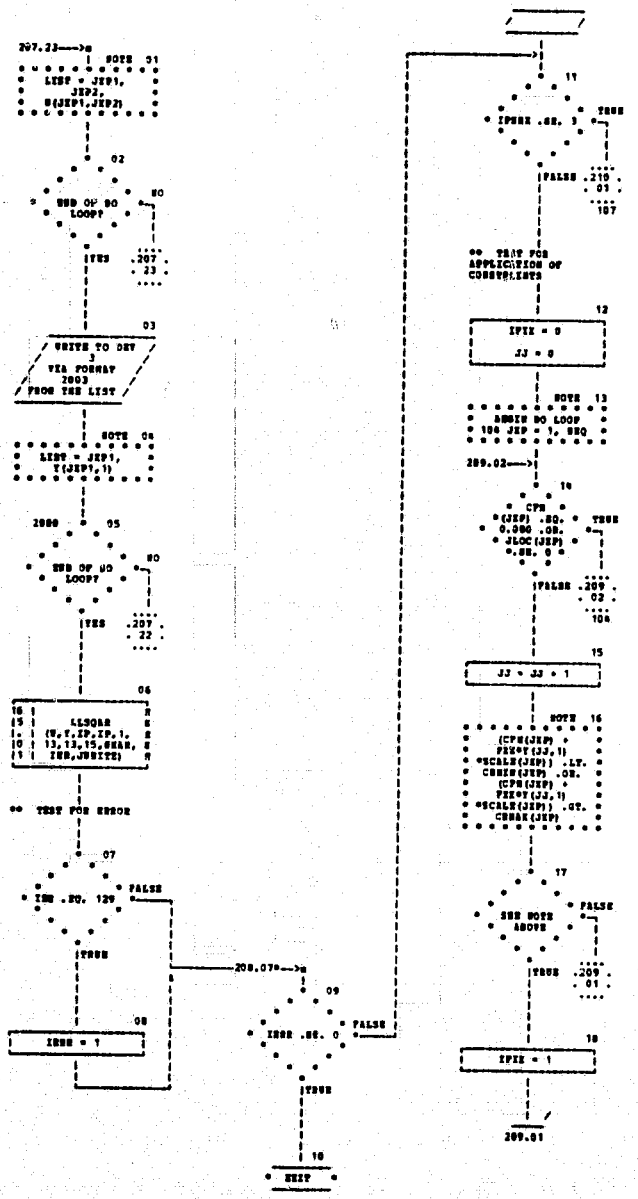


CHART TITLE - SUBROUTINE SPATH(N,F,ERR,LPRG,FIT,TABE,STABE,SDFI)



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CHART TITLE - SUBROUTINE SPATH(N,F,NEQ,LPSW,FIT,TABB,STABB,SSPI)

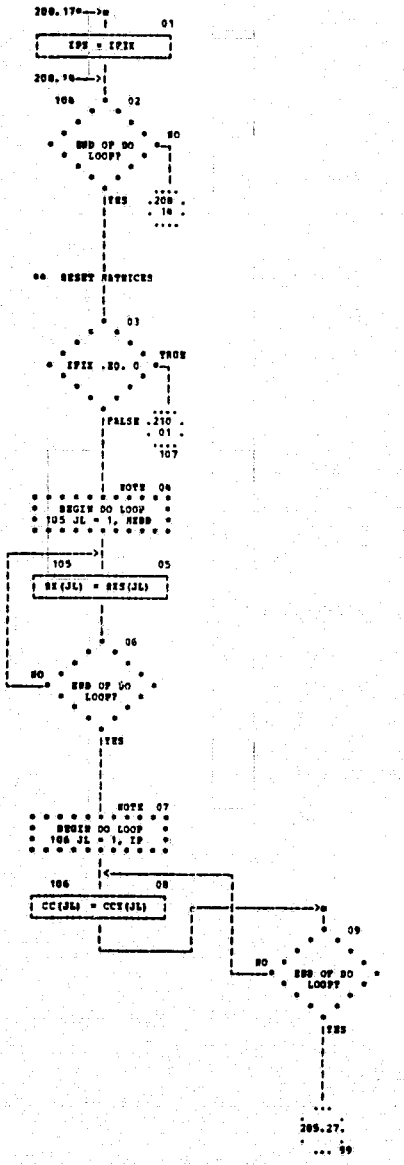
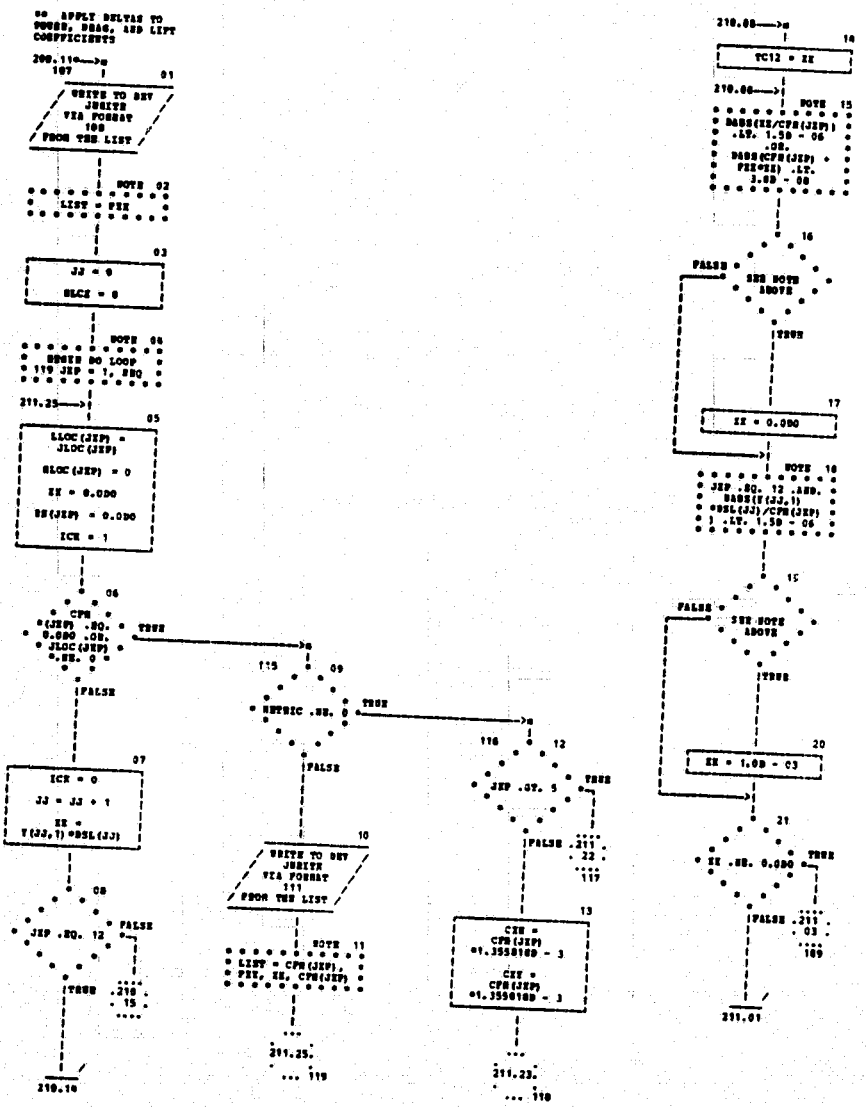


CHART TITLE - SUBROUTINE SPSTR(N,F,SSS,LPSS,FEY,YASS,UYASS,SSPX)



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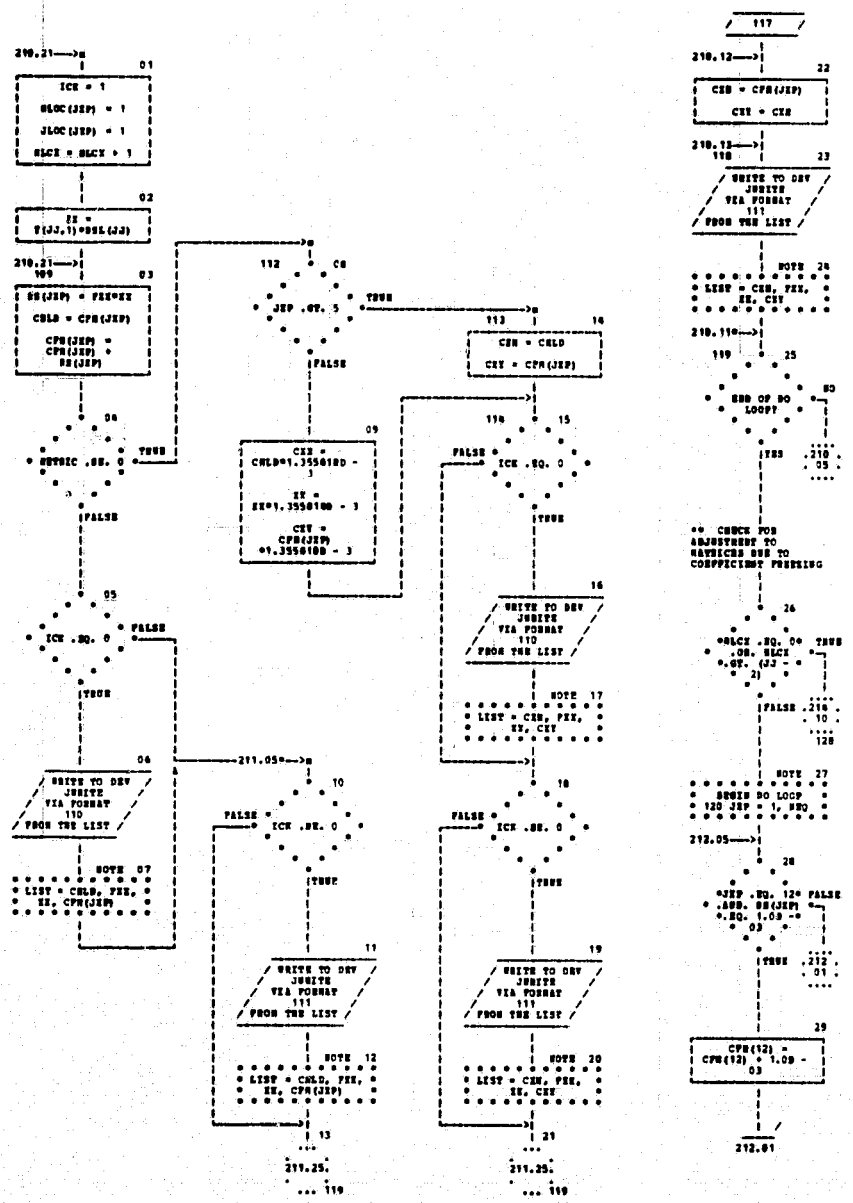
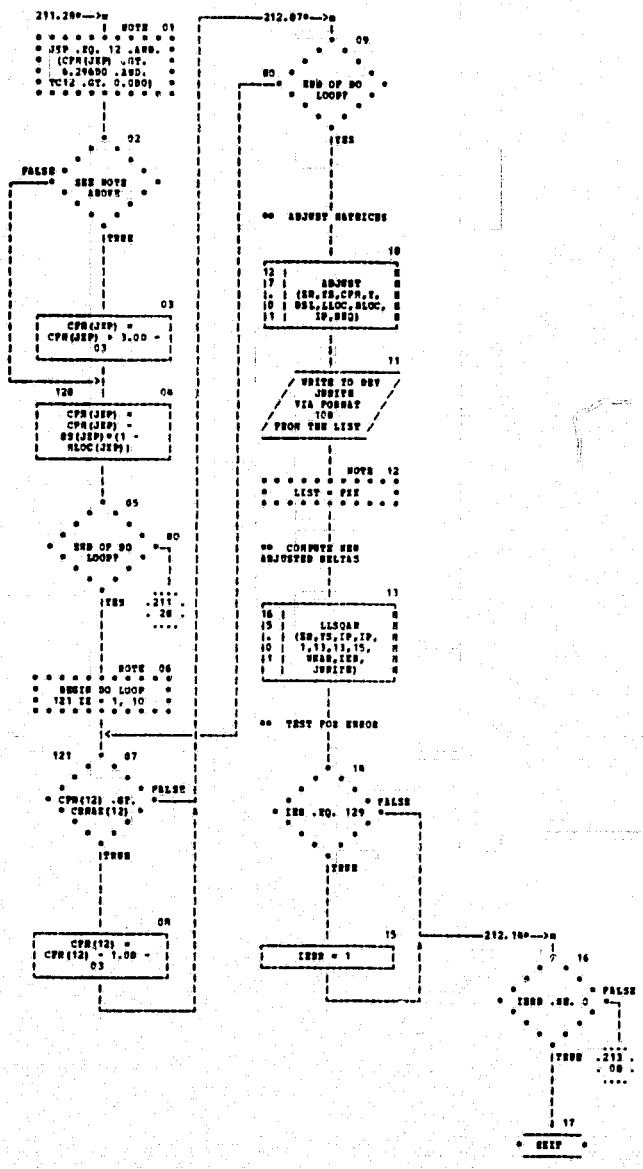


CHART TITLE - SUBROUTINE SPATH(N,P,NRD,LPRO,PIT,TAUS,MRADS,NRPI)



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CHART TITLE - SUBROUTINE RDATR(N,P,KBB,LPBC,PIT,TABB,NTABB,NRPI)

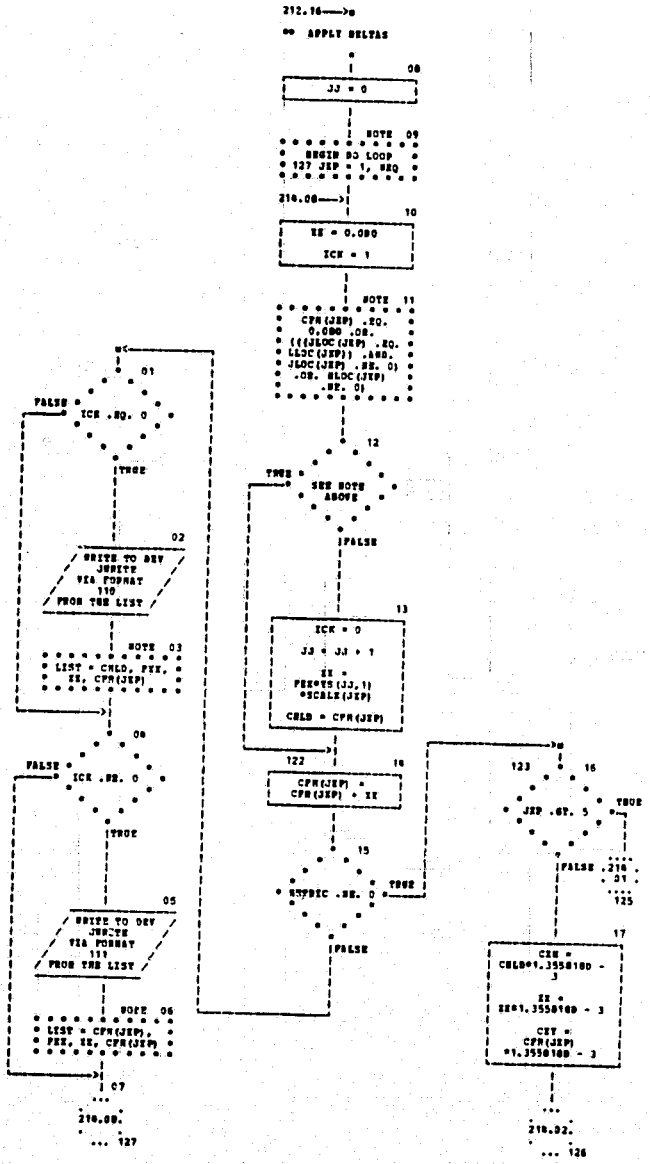
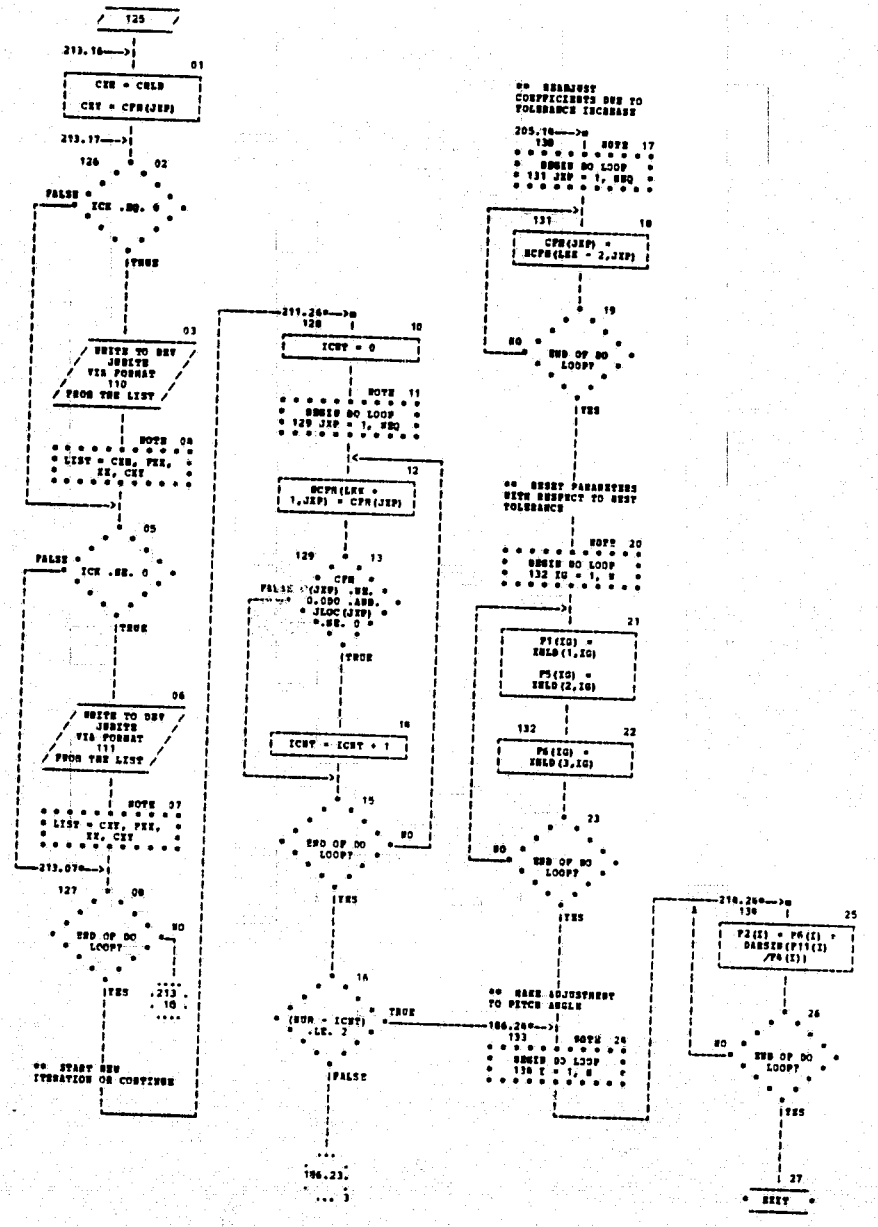


CHART TITLE - SUBROUTINE SPATH(S,P,SUB,LPRM,PIV,TABS,NTABS,NSPS)



Sample Input – FDR2

```
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

    PATH PERFORMANCE CORRUPTED THEORETICAL DATA
      1    0    0    0    0    2    1    1
0.3333     1.0          2.0          3.0               1    2    3    6
00000000000010000000                                          MODEL CARD
0.0          220000.0   0.03         0.2          0.0                    9.90D-09          1.05D-08
28735.71427D0           0.0D0
0.0D0                   0.0D0
1126.607143D0           0.0D0
-2.169642857D0          0.0D0
0.0D0                   0.0D0
0.0351D0                0.0D0
0.0D0                                1.0D-17
1.28915501 4D0          0.0D0
0.0D0                                1.0D-16
2030.800865D0           0.0D0
0.0D0                   0.0D0
6.3D0                   0.0D0
0.0D0                   0.0D0
00000000000000000000
28730.0D0               28740.0D0
0.0D0                   0.0D0
1125.0D0                1128.2D0
-2.1729D0               -2.1665D0
0.0D0                   0.0D0
0.03475D0               0.03545D0
0.0D0                   0.0D0
1.2878D0                1.300D0
0.0D0                   0.0D0
2010.0D0                2050.0D0
-0.5D0                  0.5D0
6.25D0                  6.3D0
-0.5D0                  0.0D0
  NEW CORRUPTED THEORETICAL  FDR2  NC=10 ON 1/10 OF 1% RR  TEST DATA
       298 0.15500000D 03 0.23780000D-02 0.32200000D 02 0.28490000D 02
    0.0                     0.39999996636175700 04    0.16263790512665060 00
    0.6746509799602561D-02  0.14673902490709150 03    0.23097775596360160-02
    0.16485607654255940 00  0.52000000000000000 03    0.46640419538126370 01
   -0.3801820652064249D-02  0.10000000406725110 04    0.75459540401762510-02
    0.8907990471548577D 00  0.0                       0.0
    0.9999999999999997D-02  0.39999992915295040 04    0.16270606959942740 00
    0.6886337154536199D-02  0.14678563653614200 03    0.23097775514555650-02
    0.16481821382349270 00  0.52000000000000000 03    0.46582770642063050 01
   -0.3770723552964130-02   0.10000001610329750 04    0.16562220593964010-01
    0.9124496576312505D 00  0.0                       0.0
    0.1999999999999999D-01  0.39999989193838350 04    0.16277563091885720 00
    0.7025879244284823D-02  0.14683219031271560 03    0.23097775370735490-02
    0.16478066206767280 00  0.52000000000000000 03    0.46526714810830020 01
   -0.3739628386717380D-02  0.10000003726381920 04    0.25794486567313470-01
    0.9340765483927120 00   0.0                       0.0
    0.2999999999999999D-01  0.39999985471806630 04    0.16284658623111160 00
    0.7165135737420440-02   0.14687868583055700 03    0.23097775163429730-02
    0.16474342124023780 00  0.52000000000000000 03    0.46466253404842250 01
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    0.3999999999999999D-01  0.39999981749200810 04    0.16291893266828690 00
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0.9772760601259566D 00  0.0                       0.0
0.5999999999999995D-01  0.39999974302270760 04    0.16306778737651650 00
0.7581173254002090D-02  0.14701781878949790 03    0.23097774145918460-02
0.16463356362959700 00  0.52000000000000000 03    0.46288449405432350 01
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0.1020397178843735D 01  0.0                       0.0
0.8000000000000000D-01  0.39999966853055960 04    0.16322217182125160 00
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 0.5553189663636452D-01  0.5200000000000000D 03  0.4721195967920631D 01
-0.5077021513816958D-03  0.7378076877294254D 03 -0.3462945259669908D 02
 0.6311042366933637D 01  0.0                     0.0
 0.2698999999999973D 02  0.3998901039955214D 04 -0.6785209557995270D-01
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-0.6210084111967502D-03  0.7343764971324960D 03 -0.3399252331612111D 02
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 0.2508540415229521D-01  0.2781109664543579D 03  0.2328115285353746D-02
 0.5540718333313200D-01  0.5200000000000000D 03  0.4512108663964032D 01
-0.7496586601767288D-03  0.7310095468566529D 03 -0.3334468044229480D 02
 0.6532308510468838D 01  0.0                     0.0
 0.2718999999999974D 02  0.3998892239765615D 04 -0.6283522627877820D-01
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-0.8934314628872449D-03  0.7277079179246511D 03 -0.3268613126229034D 02
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 0.2585886933928939D-01  0.2794172683439855D 03  0.2328778953814041D-02
 0.5511428482032530D-01  0.5200000000000000D 03  0.4196143167567535D 01
-0.1224762613364111D-02  0.7213048433828762D 03 -0.3133775961559087D 02
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-0.1411186868354368D-02  0.7182054540394303D 03 -0.3064836803406990D 02
 0.6943508656273533D 01  0.0                     0.0
 0.2758999999999972D 02  0.3998874650151821D 04 -0.5249335999186237D-01
 0.2634296362999873D-01  0.2802357184473240D 03  0.2329198199869298D-02
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 0.7040844290183934D 01  0.0                     0.0
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 0.5466010420465761D-01  0.5200000000000000D 03  0.3877914266124713D 01
-0.1821729419622447D-02  0.7122159484008620D 03 -0.2924027408346106D 02
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 0.2778999999999972D 02  0.3998865860790108D 04 -0.4717845275471570D-01
 0.2680192718171461D-01  0.2810108951280505D 03  0.2329598221698551D-02
 0.5446690716714725D-01  0.5200000000000000D 03  0.3771438294676001D 01
-0.2043948504158087D-02  0.7093277562966200D 03 -0.2852202113112026D 02
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 0.2702201014712394D-01  0.2813827082623074D 03  0.2329790869987198D-02
 0.5425098620445592D-01  0.5200000000000000D 03  0.3664798980015484D 01
-0.2276013297446560-02   0.7065118497155335D 03 -0.2779460204632098D 02
 0.7319250634099170D 01  0.0                     0.0
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 0.2723583790283123D-01  0.2817438502033677D 03  0.2329978522714595D-02
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-0.2516709051498548D-02  0.7037691336959868D 03 -0.2705428879350029D 02
 0.7407423186015095D 01  0.0                     0.0
 0.2808999999999972D 02  0.3998852683345325D 04 -0.3904024420792805D-01
 0.2744342422113327D-01  0.2820943078698689D 03  0.2330161118624970D-02
 0.5374739998591557D-01  0.5200000000000000D 03  0.3451117079553535D 01
-0.2764734590780794D-02  0.7011004899408743D 03 -0.2631319610632540D 02
 0.7493234858332453D 01  0.0                     0.0
 0.2818999999999972D 02  0.3998848292579039D 04 -0.3628578162218448D-01
 0.2764479351553408D-01  0.2824340703381202D 03  0.2330338598088548D-02
 0.5345827123236206D-01  0.5200000000000000D 03  0.3344117560707009D 01
-0.3018714990412121D-02  0.6985067765455203D 03 -0.2555968137897741D 02
 0.7576659839261789D 01  0.0                     0.0
 0.2828999999999972D 02  0.3998843902648302D 04 -0.3351149213051231D-01
 0.2783996403920371D-01  0.2827631288074651D 03  0.2330510903120683D-02
 0.5314350627722940D-01  0.5200000000000000D 03  0.3237040801442937D 01
-0.3277215179666687D-02  0.6959888277395998D 03 -0.2479794449782782D 02
 0.7657674085121681D 01  0.0                     0.0
 0.2838999999999971D 02  0.3998839513538033D 04 -0.3071799509020227D-01
 0.2802894628712519D-01  0.2830814766260668D 03  0.2330677977399802D-02
 0.5280272684433166D-01  0.5200000000000000D 03  0.3129907986291971D 01
-0.3538758301993454D-02  0.6935478536460666D 03 -0.2402822769353201D 02
 0.7736258413882567D 01  0.0                     0.0
 0.2848999999999971D 02  0.3998835125231997D 04 -0.2796590872515039D-01
 0.2821175297315842D-01  0.2833891092381821D 03  0.2330839766284676D-02
 0.5243570449196616D-01  0.5200000000000000D 03  0.3022740170400050D 01
-0.3801820652064231D-02  0.6911834400495402D 03 -0.2325077551131470D 02
 0.7812377853838854D 01  0.0                     0.0
END
```

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Sample Output — FDR2

```
*****************************************************************************
*                                                                           *
*        SDC CORRUPTED THEORETICAL  FDR2  DC=10 OF 1/10 OF 15 SD  TEST DATA *
*                                                                           *
*****************************************************************************
```

INPUT PARAMETERS:

```
      IOS   = 3   EA1= 0.3333000   PLO= 0.0                TI1= 0.0
      INPUT= 0   EA2= 1.0000000   PHIGH= 0.220000000 06   TAPE= 0.990000300-08
      IPLOT= 0   EA3= 2.0000000   COLO= 0.300000000D-01   HTAPE= 0.10500000D-07
      IPUNCH=0   EA4= 3.0000000   COHIGH= 0.20000000 00   G=32.2000000
      METRIC=0   K=298  S=155.0   PHO= 0.2378000000D-02   TT=28.460000
      NTh  = 2   IEX1=  1   IEX2=  2   IEX3=  3   IEX4=  0   IMODEL(I)= 0
      IMODEL(2)= 0   IMODEL(3)= 0   IMODEL(4)= 0   IMODEL(5)= 0   IMODEL(6)= 0
      IMODEL(7)= 0   IMODEL(8)= 0   IMODEL(9)= 0   IMODEL(10)=0   IMODEL(11)=0
      IMODEL(12)=1   IMODEL(13)=0   IMODEL(14)=0   IMODEL(15)=0   IMODEL(16)=0
      IMODEL(17)=0   IMODEL(18)=0   IP(1)= 0   IP(2)= 0   IP(3)= 0   IP(4)= 0
      IP(5)= 0   IP(6)= 0   IP(7)= 0   IP(8)= 0   IP(9)= 0   IP(10)=0   IP(11)=0
      IP(12)=0   IP(13)=0   IP(14)=0   IP(15)=0   IP(16)=0   IP(17)=0   IP(18)=0
```

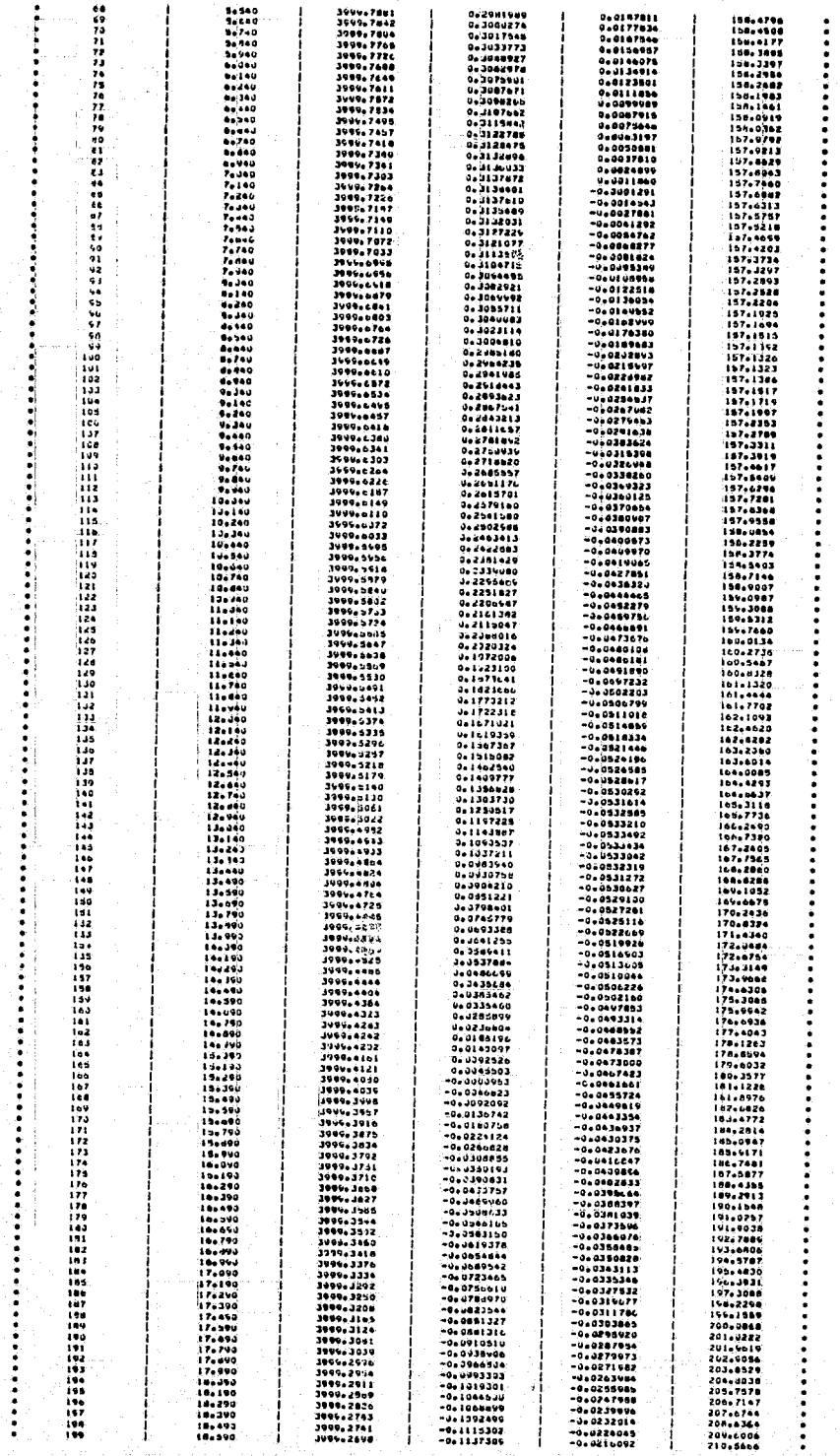
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APE( 1)= 2.87387140 06   WGT( 1)= 0.0          CMMIN( 1)= 2.8733000 06   CMMAX( 1)= 2.8740000 06
APE( 2)= 0.0             WGT( 2)= 0.0          CMMIN( 2)= 0.0            CMMAX( 2)= 0.0
APE( 3)= 1.12800710 03   WGT( 3)= 0.0          CMMIN( 3)= 1.1250000 03   CMMAX( 3)= 1.1282000 03
APE( 4)=-2.10964200 00   WGT( 4)= 0.0          CMMIN( 4)=-2.1725000 00   CMMAX( 4)=-2.1605000 00
APE( 5)= 0.0             WGT( 5)= 0.0          CMMIN( 5)= 0.0            CMMAX( 5)= 0.0
APE( 6)= 3.81000000-02   WGT( 6)= 0.0          CMMIN( 6)= 3.6750000-02   CMMAX( 6)= 3.8450000-02
APE( 7)= 0.0             WGT( 7)= 1.00000-17   CMMIN( 7)= 0.0            CMMAX( 7)= 0.0
APE( 8)= 1.28991500 00   WGT( 8)= 0.0          CMMIN( 8)= 1.2878000 00   CMMAX( 8)= 1.2933000 00
APE( 9)= 0.0             WGT( 9)= 1.00000-16   CMMIN( 9)= 0.0            CMMAX( 9)= 0.0
APE(10)= 2.93386690 03   WGT(10)= 0.0          CMMIN(10)= 2.9130000 03   CMMAX(10)= 2.9500000 03
APE(11)= 0.0             WGT(11)= 0.0          CMMIN(11)=-3.0000000-01   CMMAX(11)= 5.0000000-01
APE(12)= 0.0             WGT(12)= 0.0          CMMIN(12)= 0.0            CMMAX(12)= 0.0
APE(13)= 0.0             WGT(13)= 0.0          CMMIN(13)=-0.0300000-01   CMMAX(13)= 0.0
```

```
*****************************************
*                                       *
* WING AREA =  155.00000 FT**2          *
* REFERENCE DENSITY = 0.00237800 SLUG/FT**3
* ACCELERATION DUE TO GRAVITY = 32.2000 FT/SEC**2
* TOTAL TEST TIME =    22.4000 SECONDS  *
*                                       *
*****************************************
```

```
*****************************************************************
*                                                               *
*          INITIAL INPUT DATA (FOR PROGRAM LOOP= 1)             *
*                                                               *
*****************************************************************
```

DATA POINT	TIME (SECS)	WEIGHT (LBF)	PITCH ANGLE (RADIANS)	PITCH RATE (RADIAN/SEC)	AIRSPEED (FT/SEC)
1	0.0	3999.0997	0.1028379	0.0067988	146.7390
2	0.010	3999.0993	0.1027061	0.0066863	146.7858
3	0.020	3999.0989	0.1027756	0.0070238	146.8322
4	0.030	3999.0985	0.1026980	0.0071851	146.8787
5	0.040	3999.0982	0.1029189	0.0073041	146.9251
6	0.050	3999.0978	0.1030678	0.0070812	147.0178
7	0.060	3999.0967	0.1032222	0.0078571	147.1103
8	0.100	3999.0956	0.1033021	0.0081318	147.2025
9	0.120	3999.0952	0.1033674	0.0086053	147.2945
10	0.140	3999.0944	0.1037183	0.0080777	147.3862
11	0.180	3999.0930	0.1040762	0.0092187	147.5689
12	0.220	3999.0915	0.1044357	0.0097546	147.7508
13	0.260	3999.0900	0.1040065	0.0102869	147.9311
14	0.300	3999.0888	0.1032785	0.0110819	148.1106
15	0.340	3999.0870	0.1037214	0.0113328	148.2890
16	0.420	3999.0840	0.1038652	0.0123586	148.6626
17	0.500	3999.0810	0.1047682	0.0133828	149.0911
18	0.580	3999.0780	0.1048067	0.0143648	149.5349
19	0.883	3999.0750	0.1049992	0.0153039	149.9737
20	0.740	3999.0720	0.1712547	0.0162397	150.0073
21	0.860	3999.0682	0.1729268	0.0173758	150.4188
22	0.940	3999.0844	0.1747280	0.0184739	150.8176
23	1.040	3999.0607	0.1766292	0.0195319	151.2394
24	1.140	3999.0369	0.1786336	0.0209494	151.5921
25	1.240	3999.0531	0.1807376	0.0215241	151.9653
26	1.340	3999.0493	0.1828389	0.0224551	152.3249
27	1.440	3999.0455	0.1852271	0.0233614	152.6826
28	1.540	3999.0417	0.1876037	0.0241820	153.0263
29	1.640	3999.0380	0.1903620	0.0249762	153.3598
30	1.740	3999.0341	0.1933973	0.0257229	153.6829
31	1.840	3999.0303	0.1958150	0.0264215	153.9985
32	1.940	3999.0265	0.1978800	0.0270710	154.2978
33	2.040	3999.0227	0.2006175	0.0276714	154.5888
34	2.140	3999.0189	0.2034127	0.0282234	154.8646
35	2.240	3999.0151	0.2062648	0.0287274	155.1301
36	2.340	3999.0113	0.2091540	0.0291828	155.3979
37	2.440	3999.0076	0.2120986	0.0295896	155.6458
38	2.540	3999.0038	0.2150728	0.0299475	155.8828
39	2.640	3999.0000	0.2180834	0.0302563	156.1089
40	2.740	3999.0556	0.2211224	0.0305159	156.3241
41	2.840	3999.0921	0.2241850	0.0307263	156.5285
42	2.940	3999.0883	0.2272660	0.0308672	156.7221
43	3.040	3999.0844	0.2304607	0.0309988	156.9050
44	3.140	3999.0806	0.2334641	0.0310409	157.0773
45	3.240	3999.0767	0.2364713	0.0310736	157.2390
46	3.340	3999.0729	0.2396772	0.0310369	157.3904
47	3.440	3999.0691	0.2427770	0.0309510	157.5314
48	3.540	3999.0652	0.2458658	0.0308158	157.6623
49	3.640	3999.0614	0.2489385	0.0306315	157.7833
50	3.740	3999.0575	0.2519904	0.0303983	157.8944
51	3.840	3999.0537	0.2550166	0.0301162	157.9959
52	3.940	3999.0498	0.2580123	0.0297856	158.0880
53	4.040	3999.0459	0.2609721	0.0294066	158.1709
54	4.140	3999.0421	0.2638918	0.0289812	158.2448
55	4.240	3999.0382	0.2667668	0.0285118	158.3098
56	4.340	3999.0344	0.2695927	0.0279993	158.3665
57	4.440	3999.0305	0.2723653	0.0274444	158.4148
58	4.540	3999.0267	0.2750802	0.0268479	158.4551
59	4.640	3999.0228	0.2777338	0.0262107	158.4876
60	4.740	3999.0189	0.2803210	0.0255335	158.5127
61	4.840	3999.0151	0.2828380	0.0248172	158.5306
62	4.940	3999.0112	0.2852832	0.0240627	158.5416
63	5.040	3999.0074	0.2876502	0.0232707	158.5460
64	5.140	3999.0035	0.2899361	0.0224423	158.5441
65	5.240	3998.9997	0.2921375	0.0215782	158.5362
66	5.340	3998.9958	0.2942500	0.0206796	158.5226
67	5.440	3998.9919	0.2962722	0.0197467	158.5036

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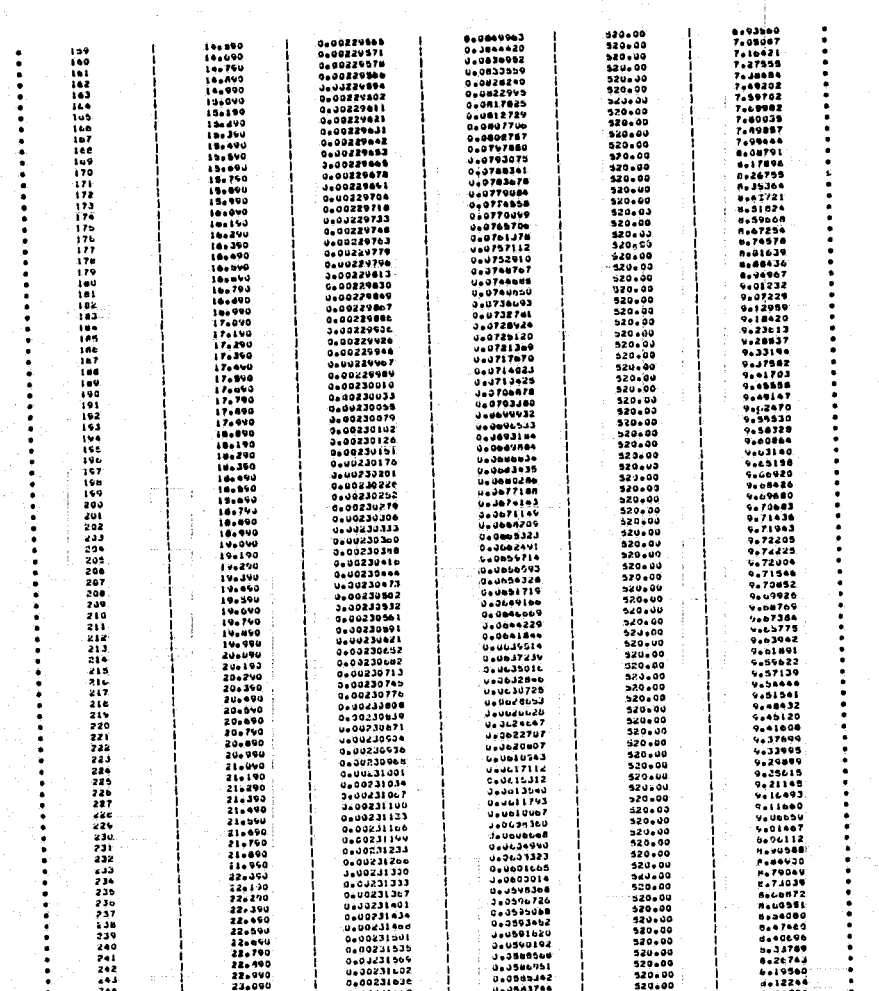


200	1.0e+00	3.999e+2655	-0.1158521	-3.0208160	211.8343
201	1.0e+00	3.999e+2612	-0.1178061	-0.0200250	212.5034
202	1.0e+00	3.999e+2569	-0.1198572	-0.0192347	213.1726
203	1.0e+00	3.999e+2526	-0.1217416	-0.0166813	213.8407
204	1.0e+00	3.999e+2483	-0.1235676	-0.0176691	215.0184
205	1.0e+00	3.999e+2440	-0.1252755	-0.0166903	216.3885
206	1.0e+00	3.999e+2398	-0.1269238	-0.0161153	217.7307
207	1.0e+00	3.999e+2355	-0.1284587	-0.0153442	219.0328
208	1.0e+00	3.999e+2312	-0.1299847	-0.0146773	219.9.3048
209	1.0e+00	3.999e+2267	-0.1314143	-0.0138149	220.2.2758
210	1.0e+00	3.999e+2223	-0.1327579	-0.0130579	221.2.2463
211	1.0e+00	3.999e+2180	-0.1340259	-0.0123061	222.2.2156
212	1.0e+00	3.999e+2136	-0.1352198	-0.0115601	223.1.1837
213	1.0e+00	3.999e+2093	-0.1363373	-0.0108136	224.1.1503
214	2.0e+00	3.999e+2049	-0.1373817	-0.0100761	225.1.1152
215	2.0e+00	3.999e+2006	-0.1383527	-0.0093442	226.0.0781
216	2.0e+00	3.999e+1962	-0.1392507	-0.0086179	227.0.0389
217	2.0e+00	3.999e+1919	-0.1400765	-0.0078973	227.9.9973
218	2.0e+00	3.999e+1875	-0.1408306	-0.0071825	228.9.9531
219	2.0e+00	3.999e+1831	-0.1415131	-0.0064736	229.9.9061
220	2.0e+00	3.999e+1788	-0.1421253	-0.0057707	230.8.8561
221	2.0e+00	3.999e+1744	-0.1426675	-0.0050740	231.8.8029
222	2.0e+00	3.999e+1700	-0.1431403	-0.0043835	232.7.7463
223	1.0e+00	3.999e+1656	-0.1435444	-0.0036993	233.6.6861
224	2.0e+00	3.999e+1612	-0.1438813	-0.0030216	234.6.6220
225	2.0e+00	3.999e+1569	-0.1441489	-0.0023503	235.5.5540
226	2.0e+00	3.999e+1525	-0.1443507	-0.0016855	236.4.4819
227	2.0e+00	3.999e+1481	-0.1444863	-0.0010274	237.4.4052
228	2.0e+00	3.999e+1437	-0.1445564	-0.0003760	238.3.3240
229	2.0e+00	3.999e+1393	-0.1445617	0.0002686	239.2.2381
230	2.0e+00	3.999e+1349	-0.1445029	0.0009086	240.1.1473
231	2.0e+00	3.999e+1305	-0.1443806	0.0015374	241.0.0513
232	2.0e+00	3.999e+1261	-0.1441956	0.0021614	241.9.9501
233	2.0e+00	3.999e+1217	-0.1439486	0.0027704	242.8.8435
234	2.0e+00	3.999e+1173	-0.1436402	0.0033888	243.7.7313
235	2.0e+00	3.999e+1129	-0.1432712	0.0039915	244.6.6132
236	2.0e+00	3.999e+1085	-0.1428421	0.0045877	245.5.4893
237	2.0e+00	3.998e+1041	-0.1423539	0.0051764	246.4.3591
238	2.0e+00	3.998e+0996	-0.1418070	0.0057591	247.3.2230
239	2.0e+00	3.998e+0952	-0.1412023	0.0063344	248.2.0803
240	2.0e+00	3.998e+0908	-0.1405404	0.0069028	249.0.9311
241	2.0e+00	3.998e+0864	-0.1398220	0.0074636	249.9.7752
242	2.0e+00	3.998e+0820	-0.1390478	0.0080181	250.8.6126
243	2.0e+00	3.998e+0776	-0.1382186	0.0085654	251.4.4427
244	2.0e+00	3.998e+0732	-0.1373350	0.0091056	252.2.2659
245	2.0e+00	3.998e+0688	-0.1363977	0.0096389	253.0.0818
246	2.0e+00	3.998e+0643	-0.1354074	0.0101651	253.9.8903
247	2.0e+00	3.998e+0599	-0.1343649	0.0106842	254.8.6913
248	2.0e+00	3.998e+0555	-0.1332708	0.0111960	255.4.4847
249	2.0e+00	3.998e+0511	-0.1321259	0.0117015	256.2.2703
250	2.0e+00	3.998e+0467	-0.1309307	0.0121998	257.0.0481
251	2.0e+00	3.998e+0422	-0.1296862	0.0126907	257.8.8178
252	2.0e+00	3.998e+0378	-0.1283928	0.0131749	258.5.5796
253	2.0e+00	3.998e+0334	-0.1270519	0.0136518	259.3.3326
254	2.0e+00	3.998e+0290	-0.1256637	0.0141219	260.0.0779
255	2.0e+00	3.998e+0246	-0.1242293	0.0145844	260.8.8144
256	2.0e+00	3.998e+0202	-0.1227496	0.0150410	261.5.5425
257	2.0e+00	3.998e+0157	-0.1212256	0.0154903	262.2.2615
258	2.0e+00	3.998e+0113	-0.1196582	0.0159327	262.9.9725
259	2.0e+00	3.998e+0069	-0.1180488	0.0163682	263.6.6743
260	2.0e+00	3.998e+0025	-0.1163987	0.0167970	264.3.3671
261	2.0e+00	3.997e+9981	-0.1147095	0.0172189	265.0.0509
262	2.0e+00	3.997e+9936	-0.1129830	0.0176340	265.7.7256
263	2.0e+00	3.997e+9892	-0.1112207	0.0180424	266.4.3910
264	2.0e+00	3.997e+9848	-0.1094245	0.0184440	267.0.0472
265	2.0e+00	3.997e+9804	-0.1075967	0.0188389	267.6.6939
266	2.0e+00	3.997e+9760	-0.1057394	0.0192270	268.3.3313
267	2.0e+00	3.997e+9716	-0.1038550	0.0196085	268.9.9598
268	2.0e+00	3.997e+9672	-0.1019455	0.0199832	269.6.5772
269	2.0e+00	3.997e+9627	-0.1000131	0.0203513	270.2.1847
270	2.0e+00	3.997e+9583	-0.0980604	0.0207127	270.7.7845
271	2.0e+00	3.997e+9539	-0.0960898	0.0210674	271.3.3736
272	2.0e+00	3.997e+9495	-0.0941036	0.0214153	271.9.9529
273	2.0e+00	3.997e+9451	-0.0921049	0.0217572	272.5.5218
274	2.0e+00	3.997e+9407	-0.0900959	0.0220921	273.0.0807
275	2.0e+00	3.996e+9363	-0.0880797	0.0224205	273.6.6298
276	2.0e+00	3.996e+9319	-0.0860585	0.0227424	274.1.1688
277	2.0e+00	3.996e+9275	-0.0840254	0.0230578	274.6.6976
278	2.0e+00	3.996e+9231	-0.0819848	0.0233667	275.2.2162
279	2.0e+00	3.996e+9187	-0.0799382	0.0236692	275.7.7245
280	2.0e+00	3.996e+9142	-0.0778885	0.0239652	276.2.2226
281	2.0e+00	3.996e+9098	-0.0758398	0.0242548	276.7.7103
282	2.0e+00	3.996e+9054	-0.0737919	0.0245381	277.1.1876
283	2.0e+00	3.996e+9010	-0.0717521	0.0248149	277.6.6546
284	2.0e+00	3.995e+8966	-0.0697198	0.0250854	278.1.1110
285	2.0e+00	3.995e+8922	-0.0676982	0.0253496	278.5.5569
286	2.0e+00	3.995e+8878	-0.0656873	0.0256074	278.9.9924
287	2.0e+00	3.995e+8834	-0.0636914	0.0258589	279.4.4173
288	2.0e+00	3.995e+8790	-0.0617141	0.0261041	279.8.8316
289	2.0e+00	3.995e+8747	-0.0597494	0.0263430	280.2.2353
290	2.0e+00	3.995e+8703	-0.0578014	0.0265756	280.6.6284
291	2.0e+00	3.995e+8659	-0.0558705	0.0268019	281.0.0109
292	2.0e+00	3.995e+8615	-0.0539572	0.0270220	281.3.3827
293	2.0e+00	3.994e+8571	-0.0520744	0.0272358	281.7.7439
294	2.0e+00	3.994e+8527	-0.0502232	0.0274434	282.0.0943
295	2.0e+00	3.994e+8483	-0.0484068	0.0276448	282.4.4341
296	2.0e+00	3.994e+8439	-0.0466276	0.0278400	282.7.7631
297	2.0e+00	3.994e+8395	-0.0448880	0.0280289	283.0.0815
298	2.0e+00	3.994e+8351	-0.0431906	0.0282118	283.3.3891

DATA POINT	TIME (SECS)	DENSITY (SLUG/FT**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-R)	ACCELERATION (FT/SEC**2)
1	0.0	0.00230978	0.1648581	520.00	4.88404
2	0.010	0.00230978	0.1648182	520.00	4.88828
3	0.020	0.00230978	0.1647807	520.00	4.89247
4	0.030	0.00230978	0.1647434	520.00	4.89663
5	0.040	0.00230978	0.1647065	520.00	4.90074
6	0.050	0.00230978	0.1646336	520.00	4.90884
7	0.060	0.00230978	0.1645619	520.00	4.91678
8	0.100	0.00230978	0.1644914	520.00	4.94838
9	0.120	0.00230978	0.1644222	520.00	4.96221
10	0.140	0.00230978	0.1643563	520.00	4.97968
11	0.180	0.00230978	0.1642220	520.00	4.98416
12	0.220	0.00230978	0.1640647	520.00	4.98803
13	0.260	0.00230977	0.1639723	520.00	4.99129
14	0.300	0.00230977	0.1638567	520.00	4.97396
15	0.340	0.00230977	0.1637619	520.00	4.94804
16	0.420	0.00230977	0.1635306	520.00	4.88849
17	0.500	0.00230977	0.1633379	520.00	4.82871
18	0.580	0.00230976	0.1631632	520.00	4.76878
19	0.660	0.00230976	0.1630060	520.00	4.70878
20	0.740	0.00230975	0.1628652	520.00	4.64879
21	0.820	0.00230974	0.1627395	520.00	4.58883
22	0.900	0.00230973	0.1626287	520.00	3.96385
23	1.000	0.00230972	0.1624744	520.00	3.87302
24	1.100	0.00230970	0.1623357	520.00	3.77989
25	1.200	0.00230969	0.1623145	520.00	3.68446
26	1.300	0.00230967	0.1622588	520.00	3.58688

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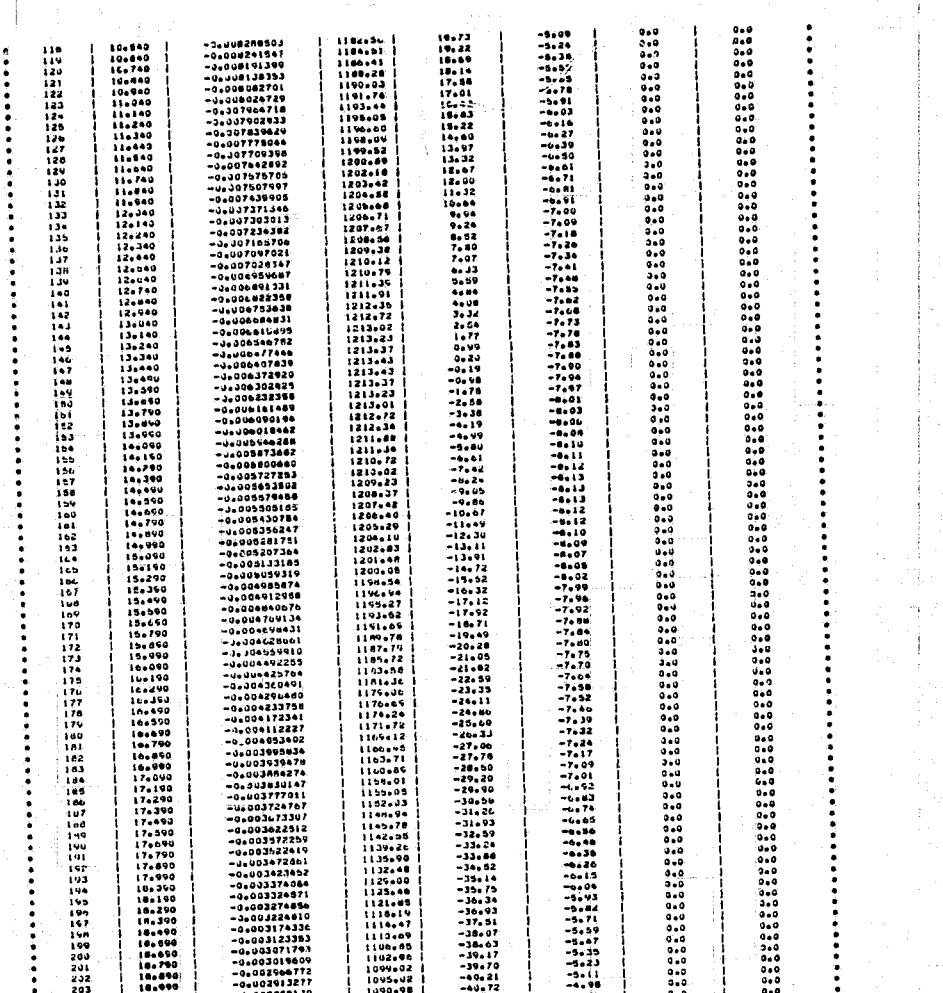
27	1e480	0e00230de4	0e1ddd198	520.00	3e46738	
28	1e540	0e00230ec2	0e1621837	520.00	3e48604	
29	1e600	3e00230f59	0e1621800	520.00	3e48314	
30	1e7c0	0e00230fe8	0e1621823	520.00	3e47884	
31	1e480	0e00230f53	0e1621283	520.00	3e47331	
32	1e540	0e00230950	0e1621185	520.00	2e46875	
33	2e000	0e00230e4e	0e1621017	520.00	2e45934	
34	2e1c0	3e00230942	0e1620886	520.00	2e78128	
35	2e280	0e00230937	0e1620880	520.00	2e46286	
36	2e340	0e00230932	0e1620310	520.00	2e33373	
37	2e400	0e00230947	0e1619422	520.00	2e48e04	
38	2e4c0	0e00230922	0e1619411	520.00	2e31b85	
39	2e580	0e00230918	0e1618769	520.00	2e20881	
40	2e740	0e00230910	0e1617979	520.00	2e09809	
41	2e800	0e00230904	0e1617028	520.00	1e98986	
42	2e9c0	0e00230897	0e1615903	523.00	1e88235	
43	3e080	0e00230890	0e1616593	520.00	1e77984	
44	3e140	3e00230982	0e1613287	520.00	1e48986	
45	3e200	0e00230874	0e1611378	528.00	1e58518	
46	3e2c0	0e00230866	0e1609466	520.00	1e46170	
47	3e480	0e00230857	0e1607328	520.00	1e35960	
48	3e540	0e00230848	0e1604978	520.00	1e25282	
49	3e600	3e00230839	0e1602610	520.00	1e14038	
50	3e7c0	0e00230829	0e1599121	520.00	1e02291	
51	3e880	0e00230819	0e1596614	520.00	3e98766	
52	3e940	3e00230809	0e1593391	520.00	3e87443	
53	4e000	0e00230770	0e1589695	520.00	3e78326	
54	4e1c0	0e00230787	0e1586109	520.00	3e69855	
55	4e280	0e00230776	0e1582480	520.00	3e60811	
56	4e340	0e00230763	0e1578613	520.00	3e52613	
57	4e400	0e00230751	0e1574174	520.00	3e44269	
58	4e4c0	0e00230739	0e1569751	520.00	3e36388	
59	4e580	3e00230726	0e1565158	520.00	3e28777	
60	4e740	0e00230713	0e1560380	520.00	3e21444	
61	4e800	0e00230699	0e1555467	520.00	3e14305	
62	4e9c0	0e00230685	0e1550160	528.00	3e07639	
63	5e080	0e00230671	0e1545127	520.00	3e01181	
64	5e140	0e00230657	0e1539754	520.00	-3e49973	
65	5e200	0e00230642	0e1534250	520.00	-3e10817	
66	5e3c0	0e00230627	0e1528620	523.00	-3e46365	
67	5e480	0e00230612	0e1522672	520.00	-3e21053	
68	5e540	0e00230596	0e1517011	520.00	-3e56634	
69	5e600	3e00230580	0e1511044	520.00	-3e30984	
70	5e7c0	0e00230564	0e1504974	520.00	-3e02620	
71	5e880	0e00230548	0e14984b8	520.00	-3e39076	
72	5e940	0e00230531	0e1492646	520.00	-3e42606	
73	6e000	0e00230514	0e1486199	520.00	-3e45795	
74	6e1c0	0e00230478	0e1479762	523.00	-3e48831	
75	6e280	0e00230430	0e1473262	520.00	-3e31115	
76	6e340	0e00230403	0e1466649	523.00	-3e53265	
77	6e400	0e00230456	0e1459961	520.00	-3e55020	
78	6e5c0	0e00230428	0e1453193	520.00	-3e54437	
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81	6e800	3e00230374	0e1432434	523.00	-3e58536	
82	6e9c0	0e00230356	0e1425360	520.00	-3e38516	
83	7e080	0e00230338	0e1418208	523.00	-3e28136	
84	7e140	0e00230114	0e1410979	520.00	-3e37391	
85	7e200	0e00230301	0e1403672	520.00	-3e66287	
86	7e3c0	0e00230283	0e1396249	523.00	-3e56822	
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88	7e540	0e00230246	0e1381161	523.00	-3e50812	
89	7e600	0e00230227	0e1373679	520.00	-3e48269	
90	7e7c0	0e00230208	0e13b5991	520.00	-3e49367	
91	7e880	0e00230190	0e1358230	520.00	-3e42110	
92	7e940	0e00230171	0e1350297	520.00	-3e38457	
93	8e000	0e00230153	0e1342463	520.00	-3e30532	
94	8e1c0	0e00230134	0e1334520	520.00	-3e30219	
95	8e280	0e00230116	0e1326642	520.00	-3e25380	
96	8e340	3e00230098	0e1318841	520.00	-3e20539	
97	8e400	0e00230079	0e1310221	490.00	-3e15184	
98	8e5c0	0e00230061	0e1302004	520.00	-3e09490	
99	8e680	0e00230043	0e1293735	520.00	-3e03658	
100	8e740	0e00230024	0e1285610	520.00	3e02907	
101	8e800	0e00230008	0e1277057	520.00	3e09801	
102	8e9c0	0e00229990	0e1268668	520.00	3e16020	
103	9e080	3e00229973	3e1260225	520.00	3e23960	
104	9e140	0e00229956	0e1251763	520.00	3e31615	
105	9e200	0e00229939	0e1243276	520.00	3e39982	
106	9e3c0	0e00229922	0e1234776	520.00	3e47854	
107	9e480	0e00229905	0e1226254	520.00	3e56425	
108	9e540	3e00229889	3e1217737	520.00	3e63291	
109	9e600	0e00229877	0e1209213	570.00	3e74444	
110	9e7c0	0e00229857	0e1200693	520.00	0e83878	
111	9e880	0e00229841	0e1192182	520.00	0e93585	
112	9e940	0e00229825	0e1183685	520.00	1e03599	
113	10e040	3e00229810	0e1175208	523.00	-e13793	
114	10e140	3e00229796	0e1166756	570.00	1e24277	
115	10e240	0e00229781	0e1158332	520.00	1e35006	
116	10e340	0e00229767	0e1149943	520.00	1e45945	
117	10e440	3e00229753	0e1141590	540.00	1e57159	
118	10e540	3e00229739	3e1133280	520.00	1e68e68	
119	10e640	0e00229726	0e1125015	520.00	1e80187	
120	10e740	0e00229713	0e1116798	520.00	1e92006	
121	10e840	0e00229701	0e1108633	520.00	2e04016	
122	10e940	0e00229689	0e1100522	520.00	2e16208	
123	11e040	0e00229677	0e1092468	520.00	2e28573	
124	11e140	0e00229666	0e1084473	520.00	2e41099	
125	11e240	0e00229655	0e1076539	520.00	2e53778	
126	11e340	3e00229644	0e1068668	520.00	2e66598	
127	11e440	0e00229634	0e1060860	520.00	2e79550	
128	11e540	0e00229625	0e1053118	520.00	2e92623	
129	11e640	0e00229615	0e1045442	520.00	3e05806	
130	11e740	3e00229607	0e1037833	520.00	3e19094	
131	11e840	3e00229598	0e1030291	520.00	3e32459	
132	11e940	0e00229590	0e1022817	520.00	3e45907	
133	12e040	3e00229583	0e1015411	520.00	3e59421	
134	12e140	0e00229576	0e1008076	520.00	3e72985	
135	12e240	0e00229570	0e1000805	520.00	3e86602	
136	12e340	3e00229564	0e0993606	520.00	4e00247	
137	12e440	3e00229558	0e09de474	520.00	4e13915	
138	12e540	3e00229553	3e0979411	520.00	4e27594	
139	12e640	0e00229548	0e0972417	520.00	4e41273	
140	12e740	3e00229544	0e0965491	520.00	4e54961	
141	12e840	0e00229541	0e0958633	520.00	4e68589	
142	12e940	0e00229538	0e0951847	520.00	4e82204	
143	13e040	0e00229535	3e0945128	520.00	4e95778	
144	13e140	0e00229533	0e0938477	520.00	5e09299	
145	13e240	0e00229532	0e0931896	520.00	5e22758	
146	13e340	3e00229531	0e0925384	520.00	5e36144	
147	13e440	0e00229531	0e0918941	520.00	5e49448	
148	13e540	3e00229531	0e0912574	520.00	5e62665	
149	13e640	0e00229531	0e0906288	520.00	5e75727	
150	13e740	0e00229532	0e0900140	520.00	5e88283	
151	13e790	3e00229533	0e0894043	520.00	5e95223	
152	13e860	0e00229535	0e0e8817	520.00	0e08019	
153	13e940	0e00229538	0e0884763	520.00	0e20721	
154	14e040	0e00229541	0e0878781	520.00	0e33262	
155	14e100	3e00229545	3e0872871	520.00	0e45652	
156	14e200	0e00229549	0e0867033	520.00	0e57685	
157	14e300	0e00229554	0e0861269	520.00	0e69752	
158	14e400	3e00229559	0e0855579	520.00	0e81466	



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291	27.990	0.00232568	0.3564084	520.00	0.0	3.77144
292	27.990	0.00232579	0.3562510	520.00	0.0	3.66480
293	27.990	0.00232598	0.3560914	520.00	0.0	3.55802
294	28.000	0.00233016	0.3557474	520.00	0.0	3.45112
295	28.190	0.00233036	0.3553683	520.00	0.0	3.34412
296	28.200	0.00233051	0.3551435	520.00	0.0	3.23704
297	28.390	0.00233068	0.3528027	520.00	0.0	3.12991
298	28.400	0.00233084	0.3526357	520.00	0.0	3.02274

DATA POINT	TIME (SECS)	ANGLE-OF-ATTACK RATE (RADIAN/SEC)	ALTITUDE (FT)	ALTITUDE RATE (FT/SEC)	ALT. ACCEL. (FT/SEC**2)	VERT. ACCEL. (FT/SEC**2)	ELEV. DEFLECT. (RADIANS)
1	0.0	-0.0003601671	1000.00	0.01	0.49	0.0	0.0
2	0.010	-0.0003770723	1000.00	0.02	0.91	0.0	0.0
3	0.020	-0.0003734828	1000.00	0.03	0.63	0.0	0.0
4	0.030	-0.0003706535	1000.00	0.04	0.53	0.0	0.0
5	0.040	-0.0003677483	1000.00	0.05	0.94	0.0	0.0
6	0.050	-0.0003615331	1000.00	0.06	0.94	0.0	0.0
7	0.060	-0.0003555218	1000.00	0.08	1.02	0.0	0.0
8	0.070	-0.0003491232	1000.01	0.09	1.08	0.0	0.0
9	0.080	-0.0003429316	1000.01	0.11	1.11	0.0	0.0
10	0.090	-0.0003367817	1000.01	0.13	1.13	0.0	0.0
11	0.100	-0.0003306322	1000.01	0.15	1.14	0.0	0.0
12	0.110	-0.0003244822	1000.02	0.18	1.15	0.0	0.0
13	0.120	-0.0003183179	1000.02	0.20	1.16	0.0	0.0
14	0.130	-0.0003121794	1000.03	0.23	1.16	0.0	0.0
15	0.140	-0.0003060007	1000.04	0.26	1.16	0.0	0.0
16	0.150	-0.0002998321	1000.04	0.29	1.16	0.0	0.0
17	0.160	-0.0002936634	1000.05	0.32	1.16	0.0	0.0
18	0.170	-0.0002874946	1000.06	0.35	1.16	0.0	0.0
19	0.180	-0.0002813259	1000.07	0.38	1.16	0.0	0.0
20	0.190	-0.0002752571	1000.08	0.41	1.16	0.0	0.0
21	0.200	-0.0002691883	1000.09	0.44	1.16	0.0	0.0
22	0.210	-0.0002631195	1000.10	0.47	1.16	0.0	0.0
23	0.220	-0.0002570507	1000.11	0.50	1.16	0.0	0.0
24	0.230	-0.0002509819	1000.12	0.53	1.16	0.0	0.0
25	0.240	-0.0002449131	1000.13	0.56	1.16	0.0	0.0
26	0.250	-0.0002388443	1000.14	0.59	1.16	0.0	0.0
27	0.260	-0.0002327755	1000.15	0.62	1.16	0.0	0.0
28	0.270	-0.0002267067	1000.16	0.65	1.16	0.0	0.0
29	0.280	-0.0002206379	1000.17	0.68	1.16	0.0	0.0
30	0.290	-0.0002145691	1000.18	0.71	1.16	0.0	0.0
31	0.300	-0.0002085003	1000.19	0.74	1.16	0.0	0.0
32	0.310	-0.0002024315	1000.20	0.77	1.16	0.0	0.0
33	0.320	-0.0001963627	1000.21	0.80	1.16	0.0	0.0
34	0.330	-0.0001902939	1000.22	0.83	1.16	0.0	0.0
35	0.340	-0.0001842251	1000.23	0.86	1.16	0.0	0.0
36	0.350	-0.0001781563	1000.24	0.89	1.16	0.0	0.0
37	0.360	-0.0001720875	1000.25	0.92	1.16	0.0	0.0
38	0.370	-0.0001660187	1000.26	0.95	1.16	0.0	0.0
39	0.380	-0.0001599499	1000.27	0.98	1.16	0.0	0.0
40	0.390	-0.0001538811	1000.28	1.01	1.16	0.0	0.0
41	0.400	-0.0001478123	1000.29	1.04	1.16	0.0	0.0
42	0.410	-0.0001417435	1000.30	1.07	1.16	0.0	0.0
43	0.420	-0.0001356747	1000.31	1.10	1.16	0.0	0.0
44	0.430	-0.0001296059	1000.32	1.13	1.16	0.0	0.0
45	0.440	-0.0001235371	1000.33	1.16	1.16	0.0	0.0
46	0.450	-0.0001174683	1000.34	1.19	1.16	0.0	0.0
47	0.460	-0.0001113995	1000.35	1.22	1.16	0.0	0.0
48	0.470	-0.0001053307	1000.36	1.25	1.16	0.0	0.0
49	0.480	-0.0000992619	1000.37	1.28	1.16	0.0	0.0
50	0.490	-0.0000931931	1000.38	1.31	1.16	0.0	0.0
51	0.500	-0.0000871243	1000.39	1.34	1.16	0.0	0.0
52	0.510	-0.0000810555	1000.40	1.37	1.16	0.0	0.0
53	0.520	-0.0000749867	1000.41	1.40	1.16	0.0	0.0
54	0.530	-0.0000689179	1000.42	1.43	1.16	0.0	0.0
55	0.540	-0.0000628491	1000.43	1.46	1.16	0.0	0.0
56	0.550	-0.0000567803	1000.44	1.49	1.16	0.0	0.0
57	0.560	-0.0000507115	1000.45	1.52	1.16	0.0	0.0
58	0.570	-0.0000446427	1000.46	1.55	1.16	0.0	0.0
59	0.580	-0.0000385739	1000.47	1.58	1.16	0.0	0.0
60	0.590	-0.0000325051	1000.48	1.61	1.16	0.0	0.0
61	0.600	-0.0000264363	1000.49	1.64	1.16	0.0	0.0
62	0.610	-0.0000203675	1000.50	1.67	1.16	0.0	0.0
63	0.620	-0.0000142987	1000.51	1.70	1.16	0.0	0.0
64	0.630	-0.0000082299	1000.52	1.73	1.16	0.0	0.0
65	0.640	-0.0000021611	1000.53	1.76	1.16	0.0	0.0
66	0.650	0.0000039077	1000.54	1.79	1.16	0.0	0.0
67	0.660	0.0000099765	1000.55	1.82	1.16	0.0	0.0
68	0.670	0.0000160453	1000.56	1.85	1.16	0.0	0.0
69	0.680	0.0000221141	1000.57	1.88	1.16	0.0	0.0
70	0.690	0.0000281829	1000.58	1.91	1.16	0.0	0.0
71	0.700	0.0000342517	1000.59	1.94	1.16	0.0	0.0
72	0.710	0.0000403205	1000.60	1.97	1.16	0.0	0.0
73	0.720	0.0000463893	1000.61	2.00	1.16	0.0	0.0
74	0.730	0.0000524581	1000.62	2.03	1.16	0.0	0.0
75	0.740	0.0000585269	1000.63	2.06	1.16	0.0	0.0
76	0.750	0.0000645957	1000.64	2.09	1.16	0.0	0.0
77	0.760	0.0000706645	1000.65	2.12	1.16	0.0	0.0
78	0.770	0.0000767333	1000.66	2.15	1.16	0.0	0.0
79	0.780	0.0000828021	1000.67	2.18	1.16	0.0	0.0
80	0.790	0.0000888709	1000.68	2.21	1.16	0.0	0.0
81	0.800	0.0000949397	1000.69	2.24	1.16	0.0	0.0
82	0.810	0.0001010085	1000.70	2.27	1.16	0.0	0.0
83	0.820	0.0001070773	1000.71	2.30	1.16	0.0	0.0
84	0.830	0.0001131461	1000.72	2.33	1.16	0.0	0.0
85	0.840	0.0001192149	1000.73	2.36	1.16	0.0	0.0
86	0.850	0.0001252837	1000.74	2.39	1.16	0.0	0.0
87	0.860	0.0001313525	1000.75	2.42	1.16	0.0	0.0
88	0.870	0.0001374213	1000.76	2.45	1.16	0.0	0.0
89	0.880	0.0001434901	1000.77	2.48	1.16	0.0	0.0
90	0.890	0.0001495589	1000.78	2.51	1.16	0.0	0.0
91	0.900	0.0001556277	1000.79	2.54	1.16	0.0	0.0
92	0.910	0.0001616965	1000.80	2.57	1.16	0.0	0.0
93	0.920	0.0001677653	1000.81	2.60	1.16	0.0	0.0
94	0.930	0.0001738341	1000.82	2.63	1.16	0.0	0.0
95	0.940	0.0001799029	1000.83	2.66	1.16	0.0	0.0
96	0.950	0.0001859717	1000.84	2.69	1.16	0.0	0.0
97	0.960	0.0001920405	1000.85	2.72	1.16	0.0	0.0
98	0.970	0.0001981093	1000.86	2.75	1.16	0.0	0.0
99	0.980	0.0002041781	1000.87	2.78	1.16	0.0	0.0
100	0.990	0.0002102469	1000.88	2.81	1.16	0.0	0.0
101	1.000	0.0002163157	1000.89	2.84	1.16	0.0	0.0
102	1.010	0.0002223845	1000.90	2.87	1.16	0.0	0.0
103	1.020	0.0002284533	1000.91	2.90	1.16	0.0	0.0
104	1.030	0.0002345221	1000.92	2.93	1.16	0.0	0.0
105	1.040	0.0002405909	1000.93	2.96	1.16	0.0	0.0
106	1.050	0.0002466597	1000.94	2.99	1.16	0.0	0.0
107	1.060	0.0002527285	1000.95	3.02	1.16	0.0	0.0
108	1.070	0.0002587973	1000.96	3.05	1.16	0.0	0.0
109	1.080	0.0002648661	1000.97	3.08	1.16	0.0	0.0
110	1.090	0.0002709349	1000.98	3.11	1.16	0.0	0.0
111	1.100	0.0002770037	1000.99	3.14	1.16	0.0	0.0
112	1.110	0.0002830725	1001.00	3.17	1.16	0.0	0.0
113	1.120	0.0002891413	1001.01	3.20	1.16	0.0	0.0
114	1.130	0.0002952101	1001.02	3.23	1.16	0.0	0.0
115	1.140	0.0003012789	1001.03	3.26	1.16	0.0	0.0
116	1.150	0.0003073477	1001.04	3.29	1.16	0.0	0.0
117	1.160	0.0003134165	1001.05	3.32	1.16	0.0	0.0



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250	23e690	-0.001477648	876e10	-48.21	1e98	0.0	0.0
251	23e790	-0.3384482068	869e29	-48.30	2e09	0.0	0.0
252	23e860	-0.001401840	866e58	-47.79	2e85	0.0	0.0
253	23e960	-0.001236e28	859e73	-47.86	2e40	0.0	0.0
254	24e030	-0.001307380	854e99	-47.31	2e88	0.0	0.0
255	24e100	-0.001253329	850e27	-47.05	2e70	0.0	0.0
256	24e270	-0.001196991	845e38	-46.77	2e85	0.0	0.0
257	24e350	-0.001172674	840e92	-46.67	3e00	0.0	0.0
258	24e490	-0.001088774	836e29	-46.17	3e15	0.0	0.0
259	24e590	-0.3JC697774	831e69	-45.84	3e30	0.0	0.0
260	24e690	-0.000982e26	827e12	-45e51	3e45	0.0	0.0
261	24e790	-0.000852862	822e58	-45e16	3e59	0.0	0.0
262	24e860	-0.J007T8797	818e09	-44e79	3e76	0.0	0.0
263	24e960	-0.J007U3615	813e63	-44e41	3e88	0.0	0.0
264	25e090	-0.U0C824071	809e21	-44e01	4e02	0.0	0.0
265	25e190	-0.000856195	804e83	-43e60	4e16	0.0	0.0
266	25e290	-0.600e85788	800e49	-43e18	4e30	0.0	0.0
267	25e390	-0.0006e18511	796e19	-42e74	4e44	0.0	0.0
268	25e490	-0.600J06373	791e94	-42e26	4e58	0.0	0.0
269	25e590	-0.000259820	787e73	-41e83	5e71	0.0	0.0
270	25e690	-0.J000240326	783e57	-41e35	5e86	0.0	0.0
271	25e790	-0.000020e844	779e46	-40e86	5e98	0.0	0.0
272	25e890	-0.J000173138	775e40	-40e36	5e11	0.0	0.0
273	25e990	-0.000169201	771e39	-39e84	5e24	0.0	0.0
274	26e090	-0.000138003	767e43	-39e31	5e39	0.0	0.0
275	26e190	-0.000134667	763e53	-38e77	5e36	0.0	0.0
276	26e290	-0.000165388	759e68	-38e21	5e49	0.0	0.0
277	26e390	-0.000116581	755e88	-37e61	5e61	0.0	0.0
278	26e490	-0.000207536	752e15	-37e04	5e73	0.0	0.0
279	26e590	-0.000254990	748e48	-37e06	5e85	0.0	0.0
280	26e690	-0.000327314	744e86	-36e47	5e97	0.0	0.0
281	26e790	-0.J004098822	741e30	-35e87	6e09	0.0	0.0
282	26e890	-0.000507752	737e81	-35e26	6e20	0.0	0.0
283	26e990	-0.000821008	734e38	-35e63	6e31	0.0	0.0
284	27e090	-0.000769859	731e01	-33e59	6e42	0.0	0.0
285	27e190	-0.000865431	727e71	-33e36	6e53	0.0	0.0
286	27e290	-0.001251980	724e47	-32e69	6e64	0.0	0.0
287	27e390	-0.001226783	720e67	-32e02	6e76	0.0	0.0
288	27e490	-0.001411187	716e38	-31e34	6e86	0.0	0.0
289	27e590	-0.001616473	713e21	-30e65	6e96	0.0	0.0
290	27e690	-0.001821729	709e13	-29e95	7e06	0.0	0.0
291	27e790	-0.J02063944	706e12	-29e26	7e16	0.0	0.0
292	27e890	-0.002276013	702e21	-28e62	7e23	0.0	0.0
293	27e990	-0.002516709	699e37	-27e96	7e32	0.0	0.0
294	28e090	-0.002768735	695e62	-27e06	7e41	0.0	0.0
295	28e190	-0.003038715	692e94	-26e31	7e49	0.0	0.0
296	28e290	-0.003277215	689e36	-25e56	7e58	0.0	0.0
297	28e390	-0.003536754	685e86	-24e80	7e66	0.0	0.0
298	28e490	-0.003831821	682e46	-24e03	7e74	0.0	0.0

MODEL SOLUTIONS

MODEL 12	P0 = 4.835811933780227D 04	CD0 = 4.403718029108353000-02	
	P1 = 0.0	CD1 = 0.0	
RCINT	P2 = 4.575201297218e380D 02	CD2 = 1.3907096382734880D 00	
FAILURES	P3 = -1.00027b7854458400 00	CD3 = 0.0	
= 0	P4 = 0.0	CD4 = 1.9472637990951000D 03	

FIT ERROR= 2.948233e4551487J200-05

MODEL 12 FOUND TO BE BEST FIT

CALCULATED CONSTANT BIAS IN ANGLE OF ATTACK = -1.375853100D-07
ANGLE-OF-ATTACK BIAS < 5.0D-07. BYPASSING ANALYSIS.

INITIALIZATION OF COEFFICIENT CONVERGENCE SCHEME BY 1/3 POWER MODEL

FORM: P = 2.833900 0880881/3

CD= 1.444850-01 + -4.367200 009A + 6.475830 0198892 + -6.073130 0288883 + 1.020040 038A888

WHERE: V = AIRSPEED(FT/SEC)
A = ANGLE OF ATTACK(RADIAN)

FIT ERROR = 8.731818663D-05

	PAST	PRESENT
COEFFICIENT CONVERGENCE ITERATION # 1	2.449462948780 04	2.457810828860 04
NUMBER OF COEFFICIENTS PASSED = 0	1.092157790J2D-01	1.078938227260-01
FIT ERROR = 7.351003917490E-05	-3.070413814080-01	-3.008970390220-01
	2.C617469974303-01	2.036890394330-01

	PAST	PRESENT
COEFFICIENT CONVERGENCE ITERATION # 2	2.457810828860 04	2.467253037980 04
NUMBER OF COEFFICIENTS PASSED = 0	1.078938227280-01	1.078816.79308D-01
FIT ERROR = 7.344251322176705-05	-3.008970390220-01	-3.008267684330-01
	2.036890394330-01	2.038019878740-01

	PAST	PRESENT
	2.457253037980 06	2.457256411170 06
COEFFICIENT CONVERGENCE ITERATION # 3	1.078816793080-01	1.078811388380-01
NUMBER OF COEFFICIENTS PASSED = 1	-3.008267686330-01	-3.008240962860-01
FIT ERROR = 7.3463901584170-05	2.63801087870-01	2.63798780860-01

	PAST	PRESENT
	2.457256411170 06	2.457256341700 06
COEFFICIENT CONVERGENCE ITERATION # 4	1.078811065380-01	1.078811173520-01
NUMBER OF COEFFICIENTS PASSED = 2	-3.008241953280-01	-3.008241913680-01
FIT ERROR = 7.3463872299680-05	2.63798785050-01	2.63798798020-01

	PAST	PRESENT
	2.457256341700 06	2.457256343130 06
COEFFICIENT CONVERGENCE ITERATION # 5	1.078811173920-01	1.078811171080-01
NUMBER OF COEFFICIENTS PASSED = 3	-3.008241913880-01	-3.008241902280-01
FIT ERROR = 7.3463873878430-05	2.63798787060-01	2.63798787060-01

	PAST	PRESENT
	2.457256343130 06	2.457256363100 06
COEFFICIENT CONVERGENCE ITERATION # 6	1.078811171080-01	1.078811171130-01
NUMBER OF COEFFICIENTS PASSED = 4	-3.008241902280-01	-3.008241908680-01
FIT ERROR = 7.3463873878430-05	2.63798787060-01	2.63798787067D-01

INITIAL ESTIMATES OF LIFT COEFFICIENTS

CLA0= J.705779216272055J0-02
CLA = J.646504438120333J1 01
CLAX=-0.047987632J3eUJ810 00
EAPX= 0.2000000000JJ0000J 01
CLQ = J.0

LIFT COEFFICIENTS BY LEAST SQUARE DISTANCE

CLA0=-0.708779216272055J3-02
CLA = J.646504438120333J0 01
CLAX=-0.047987632755803810 00
EAPX= J.2000000000JJ0000J 01
CLQ= 0.0

LIFT COEFFICIENT FIT ERROR= 0.2650670477917500D-02

M O D E L S C L U T I C N S

MODEL 12	P0 =	2.790706596405272100 04	CD0 =	J.6518231d296780000-02	
	P1 =	J.0	CD1 =	0.0	
PCINT	P2 =	1.1408478716794720D 03	CD2 =	1.3173756669334682700 00	
FAILURES	P3 =	-2.235202219441737300 00	CD3 =	0.0	
0	P4 =	J.0	CD4 =	1.991313658e6895J00 03	

FIT ERROR= 7.40618J81e7J869300-08

MODEL 12 FOUND TO BE BEST FIT

****** BEGIN FREQUENCY CORRECTIONS TO ANGLE OF ATTACK ******

ITERATION= 1

LIFT COEFFICIENTS BY LEAST-SQUARE DISTANCE

CLA0 = -0.3616795610469070-02
CLA = 0.6638320431403726410 01
CLAX = -0.513215049770050J0 00
EAPX = 0.20617851504802950 01
CLQ = 0.0

FREQUENCY-DEPENDENT FIT ERROR FOR ANGLE OF ATTACK = 0.02090902480220-07

PITCH-ANGLE GAIN =	1.000426946400 00
PITCH-ANGLE BIAS =	3.617408J16190-05 RADIAN

M O D E L S O L U T I C N S

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```
 MODEL 12    P0 =  1.7C3022697416D9400 04    CD0 =  3.378088229940300D-02
             P1 =  0.0                       CD1 =  0.0
 POINT       P2 =  1.1955081469B723200 03    CD2 =  1.299137746093120D 00
 FAILURES    P3 = -2.3156595798459500D 00    CD3 =  0.0
 =  0        P4 =  0.0                       CD4 =  2.0974003876863220D 03

 FIT ERROR=  7.624233748B3e0b62D-08

                        MODEL 12 FOUND TO BE BEST FIT
```

ITERATION= 2

LIFT COEFFICIENTS BY LEAST-SQUARE DISTANCE

```
CLA0 = -0.3288393e3e5091275D-02
CLA  =  0.63798630223e87380 01
CLAA = -0.826577452133904BD 00
EXPX =  3.2C0952316362B3280 01
CL0  =  0.0
```

FREQUENCY-DEPENDENT FIT ERROR FOR ANGLE OF ATTACK = 0.0312081674132D-07

```
PITCH-ANGLE GAIN =  1.0000326707BD 00
PITCH-ANGLE BIAS = -1.911006178975D-07 RADIAN
```

MODEL SOLUTIONS

```
 MODEL 12    P0 =  2.0875715C074525400 04    CD0 =  3.371e2bb2741316303-02
             P1 =  0.0                       CD1 =  0.0
 POINT       P2 =  1.1575872620J373100 03    CD2 =  1.2982501730516210D 00
 FAILURES    P3 = -2.3258617168A1417400 00   CD3 =  0.0
 =  0        P4 =  0.0                       CD4 =  2.0081894877397620D 03

 FIT ERROR=  0.8642271740490780D-08

                        MODEL 12 FOUND TO BE BEST FIT
```

ITERATION= 3

LIFT COEFFICIENTS BY LEAST-SQUARE DISTANCE

```
CLA0 = -0.3288766872213410-02
CLA  =  0.6379963e3J0077910 01
CLAA = -0.8245872951963168D 00
EXPX =  0.2099977209968483D 01
CL0  =  0.0
```

FREQUENCY-DEPENDENT FIT ERROR FOR ANGLE OF ATTACK = 0.8093972803886D-28

```
PITCH-ANGLE GAIN =  1.0000J0258B6D 00
PITCH-ANGLE BIAS = -4.466643993036D-07 RADIAN
```

MODEL SOLUTIONS

```
 MODEL 12    P0 =  2.0851566790J0150500 04   CD0 =  3.3b4461522e7188680-02
             P1 =  0.0                       CD1 =  0.0
 POINT       P2 =  1.1624636334253102100 03  CD2 =  1.2902115801563U200 00
 FAILURES    P3 = -2.3468748579259750D 00    CD3 =  0.0
 =  0        P4 =  0.0                       CD4 =  2.0100184468776690D 03

 FIT ERROR=  0.3615833966136e50D-08

                        MODEL 12 FOUND TO BE BEST FIT
```

LIFT COEFFICIENTS BY LEAST-SQUARE DISTANCE

CLAU = -0.3291586118452833D-02
CLA = 0.3802093758413161D 01
CLAA = -0.5240876235571376D 00
EAPS = 0.2098656870396390D 01
CLO = 0.0

****** END FREQUENCY CORRECTIONS TO ANGLE OF ATTACK ******

INTERMEDIATE GENERAL EXPRESSIONS FOR POWER, DRAG COEFFICIENT, AND LIFT COEFFICIENT

P = P0 + P1*V** 3.333300D-01 + P2*V** 1.000000 00 + P3*V** 2.000000D 00 + P4*V** 3.000000 00

CD = CDO + CD1*ANG 1 + CD2*ANG 2 + CD3*ANG 3 + CD4*ANG 4

CL = CLAO + CLA*A + CLAA*ANG 2.0*R*D 00 + CLQ*R

WHERE:

V = AIRSPEED(FT/SEC)
A = ANGLE OF ATTACK(RADIANS)
R = PITCH RATE(RADIAN/SEC)

P0 = 0.2651564079630 05
P1 = 0.0
P2 = 0.1102834333630 06
P3 = -0.2734647405780 01
P4 = 0.0

CDO = 0.3334461922240-01
CD1 = 0.0
CD2 = 0.1290211580220 01
CD3 = 0.0
CD4 = 0.2010018446490 04

CLAU = -0.3291586111850-02
CLA = 0.3802093758D 01
CLAA = -0.5240876233900 00
CLQ = 0.0

MODIFIED DATA (PER PROGRAM LOOP= 1)

DATA POINT	TIME (SECS)	WEIGHT (LBF)	PITCH ANGLE (RADIANS)	PITCH RATE (RADIAN/SEC)	AIRSPEED (FT/SEC)
1	0.0	3999.9557	0.1627483	0.0017485	146.7380
2	0.010	3999.9953	0.1628125	0.3368803	146.7856
3	0.020	3999.9949	0.1628021	0.3370250	146.8322
4	0.030	3999.9945	0.1629231	0.3371631	146.8797
5	0.040	3999.9942	0.1630255	0.3373041	146.9251
6	0.050	3999.9938	0.1631744	0.0375812	147.0178
7	0.060	3999.9957	0.1633259	0.0376571	147.1103
8	0.100	3999.9959	0.1634888	0.0381318	147.1925
9	0.120	3999.9952	0.1636543	0.0384053	147.2965
10	0.140	3999.9944	0.1636252	0.0386777	147.3862
11	0.160	3999.9930	0.1641433	0.0092187	147.5869
12	0.220	3999.9915	0.1645026	0.0097568	147.7505
13	0.260	3999.9900	0.1649439	0.0102859	147.9311
14	0.300	3999.9885	0.1653861	0.0108119	148.1166
15	0.360	3999.9870	0.1658292	0.0113328	148.2980
16	0.420	3999.9860	0.1662776	0.0123566	148.4826
17	0.580	3999.9910	0.1678264	0.0133828	148.9911
18	0.580	3999.9760	0.1689154	0.0143648	149.3349
19	0.680	3999.9750	0.1701024	0.0153838	149.6737
20	0.740	3999.9720	0.1713049	0.0162397	150.0073
21	0.860	3999.9682	0.1730467	0.0173758	150.4188
22	0.980	3999.9644	0.1749432	0.0184735	150.8176
23	1.080	3999.9607	0.1767417	0.0193219	151.2096
24	1.180	3999.9569	0.1787670	0.0208498	151.6081
25	1.240	3999.9531	0.1808319	0.0215261	151.9883
26	1.360	3999.9493	0.1830122	0.0226851	152.3289
27	1.440	3999.9455	0.1852434	0.0233614	152.6826
28	1.540	3999.9417	0.1877210	0.0241020	153.0263
29	1.640	3999.9380	0.1901868	0.0249782	153.3598
30	1.740	3999.9341	0.1927108	0.0257229	153.6820
31	1.840	3999.9303	0.1953256	0.0264215	153.9955
32	1.980	3999.9265	0.1980218	0.0274710	154.2975
33	2.040	3999.9227	0.2007405	0.0276714	154.6888
34	2.160	3999.9189	0.2035106	0.0282214	154.8894
35	2.260	3999.9151	0.2063861	0.0287274	155.1301
36	2.360	3999.9113	0.2092432	0.0291628	155.3979
37	2.440	3999.9074	0.2122235	0.0295876	155.6658
38	2.560	3999.9036	0.2152521	0.0302475	155.9829
39	2.640	3999.8998	0.2182140	0.0306253	156.1089
40	2.740	3999.8959	0.2212544	0.0305139	156.3261
41	2.860	3999.8921	0.2243182	0.0307263	156.5285
42	2.960	3999.8883	0.2274436	0.0308872	156.7221
43	3.080	3999.8844	0.2304967	0.0309948	156.9050
44	3.160	3999.8806	0.2336018	0.0313039	157.0773
45	3.260	3999.8767	0.2367099	0.0313736	157.2390
46	3.360	3999.8729	0.2398172	0.0310369	157.3904
47	3.440	3999.8691	0.2429129	0.0310912	157.5314
48	3.540	3999.8652	0.2460085	0.0310859	157.6623
49	3.640	3999.8614	0.2490828	0.0306315	157.7833
50	3.740	3999.8575	0.2521356	0.0303583	157.8944
51	3.840	3999.8537	0.2551633	0.0301162	157.9959
52	3.940	3999.8498	0.2581601	0.0297856	158.0880
53	4.080	3999.8459	0.2611214	0.0290660	158.1708
54	4.160	3999.8421	0.2640628	0.0289612	158.2448
55	4.260	3999.8382	0.2669186	0.0286118	158.3099
56	4.360	3999.8344	0.2697458	0.0278893	158.3665
57	4.440	3999.8305	0.2726165	0.0278444	158.4148
58	4.540	3999.8267	0.2753357	0.0268479	158.4551
59	4.640	3999.8228	0.2778901	0.0262107	158.4878
60	4.740	3999.8189	0.2804788	0.0256335	158.5127
61	4.840	3999.8151	0.2829977	0.0248172	158.5308
62	4.940	3999.8112	0.2854631	0.0240827	158.5426
63	5.080	3999.8074	0.2878111	0.0232707	158.5480
64	5.160	3999.8035	0.2900981	0.0226823	158.5481
65	5.260	3999.7997	0.2923003	0.0215782	158.5382
66	5.360	3999.7958	0.2944184	0.0206784	158.5228
67	5.440	3999.7919	0.2964419	0.0197667	158.5038
68	5.560	3999.7881	0.2983644	0.0187811	158.4798
69	5.660	3999.7842	0.3001937	0.0177836	158.4508
70	5.760	3999.7804	0.3019216	0.0167566	158.4177
71	5.860	3999.7765	0.3035431	0.0156987	158.3805
72	5.960	3999.7726	0.3050611	0.0146078	158.3397
73	6.060	3999.7688	0.3064668	0.0136916	158.2956
74	6.160	3999.7649	0.3077597	0.0123501	158.2482
75	6.260	3999.7611	0.3089372	0.0111856	158.1983

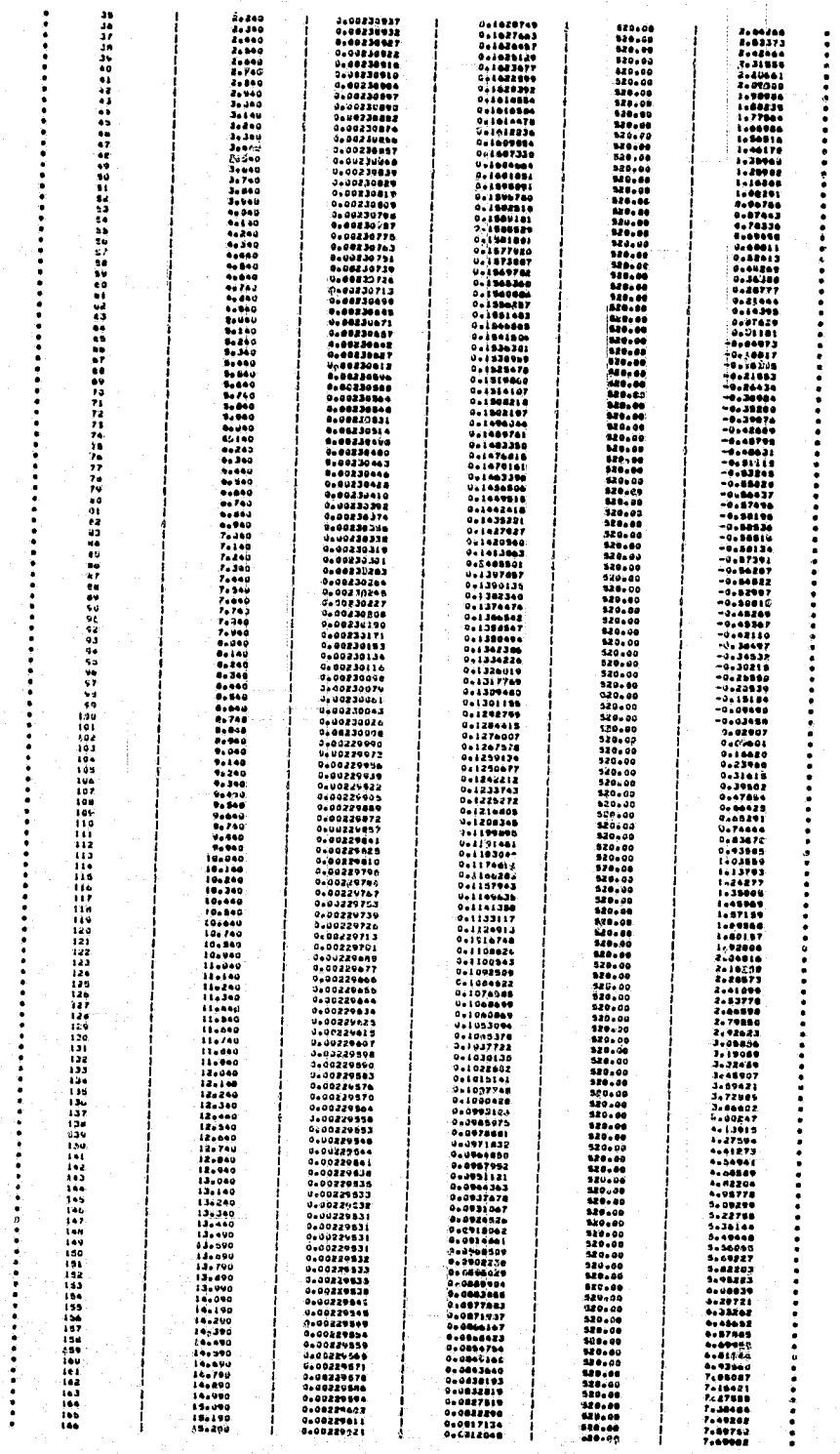
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	82	6.940	3999.7361	0.3137788	0.0024899	197.8563	
	83	7.040	3999.7302	0.3138999	0.0011860	197.7988	
	84	7.140	3999.7284	0.3140126	-0.0001291	197.6882	
	85	7.240	3999.7228	0.3139333	-0.0014863	197.6313	
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	94	8.140	3999.6879	0.3071688	-0.0136056	197.2204	
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	159	14.640	3999.4344	0.0310931	-0.0499803	216.3488	
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	170	15.740	3999.3898	-0.0197113	-0.0452960	224.7025	
	171	15.840	3999.3857	-0.0239294	-0.0448564	225.5240	
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	173	16.040	3999.3775	-0.0321879	-0.0439990	227.1956	
	174	16.140	3999.3734	-0.0362288	-0.0435856	228.0454	
	175	16.240	3999.3693	-0.0402113	-0.0431853	228.9042	
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	177	16.440	3999.3611	-0.0480027	-0.0424327	230.6482	
	178	16.540	3999.3570	-0.0518126	-0.0420847	231.5329	
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	183	17.040	3999.3365	-0.0700276	-0.0407120	236.0748	
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	192	17.940	3999.2996	-0.0995628	-0.0403902	244.6765	
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	203	19.040	3999.2544	-0.1309474	-0.0450246	255.7277	
	204	19.140	3999.2503	-0.1335926	-0.0457504	256.7534	
	205	19.240	3999.2462	-0.1362080	-0.0465270	257.7819	
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	207	19.440	3999.2380	-0.1413535	-0.0482297	259.8468	

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209	19.590	3999.2267	-0.1316361	-0.0138169	220.2758
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213	19.990	3999.2093	-0.1383612	-0.0146136	224.1503
214	20.090	3999.2049	-0.1376481	-0.0145081	225.1152
215	20.140	3999.2006	-0.1382774	-0.0145964	226.0781
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217	20.340	3999.1919	-0.1401020	-0.0078973	227.9973
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219	20.590	3999.1831	-0.1419393	-0.0066736	229.9061
220	20.640	3999.1788	-0.1421617	-0.0067707	230.8561
221	20.740	3999.1744	-0.1428982	-0.0068760	231.8029
222	20.890	3999.1700	-0.1431672	-0.0063238	232.7463
223	20.990	3999.1656	-0.1438716	-0.0036093	233.6861
224	21.090	3999.1612	-0.1439078	-0.0038216	234.6220
225	21.190	3999.1569	-0.1441762	-0.0038583	235.5540
226	21.290	3999.1525	-0.1443781	-0.0016885	236.4818
227	21.390	3999.1481	-0.1445137	-0.0010276	237.4052
228	21.490	3999.1437	-0.1445830	-0.0003760	238.3240
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230	21.690	3999.1349	-0.1445303	0.0008984	240.1473
231	21.790	3999.1305	-0.1444388	0.0015376	241.0513
232	21.890	3999.1261	-0.1442230	0.0021814	241.9501
233	21.990	3999.1217	-0.1439758	0.0027794	242.8435
234	22.090	3999.1173	-0.1436673	0.0033684	243.7312
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236	22.290	3999.1085	-0.1428689	0.0045877	245.4893
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238	22.490	3999.0998	-0.1418333	0.0057591	247.2230
239	22.590	3999.0952	-0.1412883	0.0063364	248.0803
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242	22.890	3999.0820	-0.1390729	0.0080181	250.6124
243	22.990	3999.0776	-0.1382633	0.0085684	251.4427
244	23.090	3999.0732	-0.1373693	0.0091086	252.2659
245	23.190	3999.0688	-0.1364216	0.0096289	253.0818
246	23.290	3999.0643	-0.1354309	0.0101651	253.8903
247	23.390	3999.0599	-0.1343879	0.0106842	254.6913
248	23.490	3999.0555	-0.1332934	0.0111984	255.4847
249	23.590	3999.0511	-0.1321479	0.0117015	256.2703
250	23.690	3999.0467	-0.1309523	0.0121996	257.0481
251	23.790	3999.0422	-0.1297072	0.0126987	257.8178
252	23.890	3999.0378	-0.1284133	0.0131748	258.5795
253	23.990	3999.0334	-0.1270714	0.0136318	259.3328
254	24.090	3999.0290	-0.1256820	0.0141218	260.0779
255	24.190	3999.0246	-0.1242459	0.0145868	260.8144
256	24.290	3999.0202	-0.1227639	0.0150610	261.5425
257	24.390	3999.0157	-0.1212367	0.0154903	262.2619
258	24.490	3999.0113	-0.1196648	0.0159327	262.9725
259	24.590	3999.0069	-0.1180492	0.0163682	263.6743
260	24.690	3999.0025	-0.1163899	0.0167970	264.3671
261	24.790	3998.9981	-0.1146883	0.0172189	265.0509
262	24.890	3998.9938	-0.1129449	0.0176260	265.7256
263	24.990	3998.9892	-0.1111602	0.0180424	266.3910
264	25.090	3998.9848	-0.1093381	0.0184440	267.0472
265	25.190	3998.9804	-0.1074703	0.0188389	267.6939
266	25.290	3998.9760	-0.1055659	0.0192270	268.3313
267	25.390	3998.9716	-0.1036232	0.0196085	268.9590
268	25.490	3998.9672	-0.1016427	0.0199832	269.5772
269	25.590	3998.9627	-0.0996250	0.0203513	270.1857
270	25.690	3998.9583	-0.0973739	0.0207127	270.7845
271	25.790	3998.9539	-0.0956609	0.0210675	271.3734
272	25.890	3998.9495	-0.0936358	0.0214157	271.9525
273	25.990	3998.9451	-0.0911981	0.0217572	272.5216
274	26.090	3998.9407	-0.0897076	0.0220921	273.0807
275	26.190	3998.9363	-0.0876700	0.0224205	273.6298
276	26.290	3998.9319	-0.0855869	0.0227424	274.1688
277	26.390	3998.9275	-0.0834597	0.0230578	274.6976
278	26.490	3998.9231	-0.0812895	0.0233667	275.2162
279	26.540	3998.9187	-0.0790806	0.0236692	275.7245
280	26.690	3998.9142	-0.0767876	0.0239652	276.2226
281	26.790	3998.9098	-0.0727557	0.0242548	276.7103
282	26.890	3998.9054	-0.0703149	0.0245381	277.1874
283	26.990	3998.9010	-0.0678401	0.0248149	277.6545
284	27.090	3998.8966	-0.0653300	0.0250854	278.1110
285	27.190	3998.8922	-0.0628271	0.0253496	278.5569
286	27.290	3998.8878	-0.0602791	0.0256076	278.9924
287	27.390	3998.8834	-0.0577436	0.0258589	279.4173
288	27.440	3998.8790	-0.0551083	0.0261041	279.8316
289	27.590	3998.8747	-0.0526807	0.0263430	280.2353
290	27.690	3998.8703	-0.0498336	0.0265756	280.6286
291	27.790	3998.8659	-0.0471635	0.0268019	281.0109
292	27.890	3998.8615	-0.0444711	0.0270220	281.3827
293	27.940	3998.8571	-0.0417509	0.0272358	281.7439
294	28.090	3998.8527	-0.0390217	0.0274434	282.0943
295	28.190	3998.8483	-0.0362461	0.0276448	282.4341
296	28.290	3998.8439	-0.0334906	0.0278400	282.7631
297	28.390	3998.8395	-0.0306558	0.0280289	283.0815
298	28.490	3998.8351	-0.0278823	0.0282118	293.3891

DATA POINT	TIME (SECS)	DENSITY (SLUG/FT**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-R)	ACCELERATION (FT/SEC**2)
1	0.0	0.0023078	0.1629030	520.00	4.00604
2	0.010	0.0023078	0.1629095	520.00	4.05828
3	0.020	0.0023078	0.1629167	520.00	4.05247
4	0.030	0.0023078	0.1629236	520.00	4.04663
5	0.040	0.0023078	0.1629302	520.00	4.04074
6	0.050	0.0023078	0.1629435	520.00	4.02884
7	0.060	0.0023078	0.1629567	520.00	4.01670
8	0.100	0.0023078	0.1629697	520.00	4.00458
9	0.120	0.0023078	0.1629825	520.00	4.00221
10	0.140	0.0023078	0.1629953	520.00	4.00046
11	0.180	0.0023078	0.1630201	520.00	4.00410
12	0.220	0.0023078	0.1630443	520.00	4.02863
13	0.260	0.0023077	0.1630677	520.00	4.00129
14	0.300	0.0023077	0.1630906	520.00	4.04706
15	0.340	0.0023077	0.1631126	520.00	4.04666
16	0.420	0.0023077	0.1631541	520.00	4.08849
17	0.500	0.0023077	0.1631923	520.00	4.12871
18	0.580	0.0023076	0.1632272	520.00	4.26678
19	0.661	0.0023076	0.1632585	520.00	4.40276
20	0.740	0.0023075	0.1632868	520.00	4.53679
21	0.820	0.0023074	0.1633135	520.00	4.65163
22	0.940	0.0023073	0.1633341	520.00	3.98385
23	1.060	0.0023072	0.1633561	520.00	3.87302
24	1.140	0.0023070	0.1633639	520.00	3.77980
25	1.240	0.0023069	0.1633668	520.00	3.68446
26	1.340	0.0023067	0.1633587	520.00	3.58688
27	1.440	0.0023066	0.1633441	520.00	3.48735
28	1.540	0.0023062	0.1633208	520.00	3.38684
29	1.640	0.0023059	0.1632902	520.00	3.28316
30	1.740	0.0023056	0.1632460	520.00	3.17884
31	1.840	0.0023053	0.1631937	520.00	3.07331
32	1.940	0.0023050	0.1631308	520.00	2.96678
33	2.042	0.0023048	0.1630569	520.00	2.85836
34	2.140	0.0023046	0.1629717	520.00	2.75128

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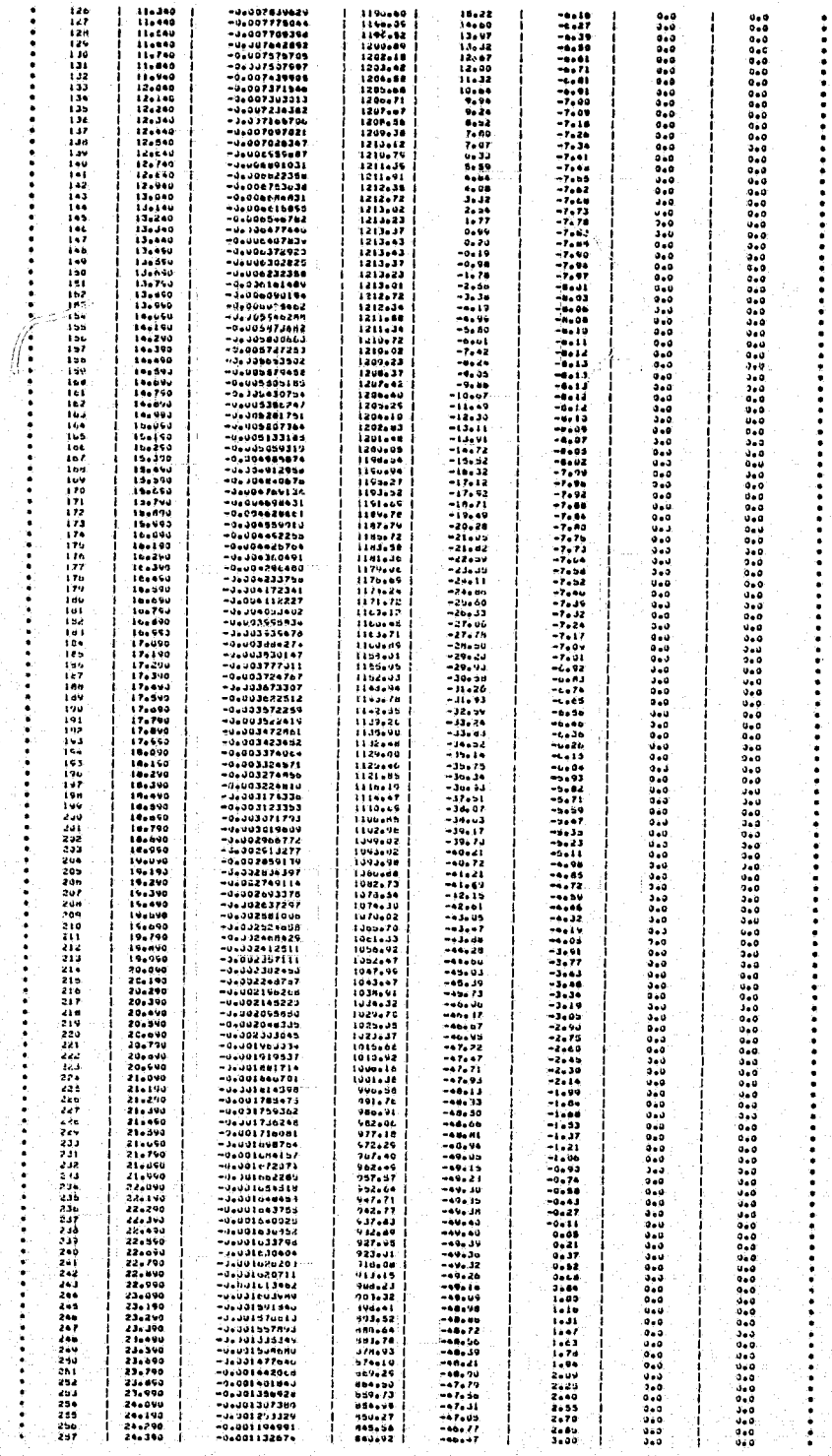


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167	18.380	0.00229631	0.0807036	520.00	7.88835	
168	18.490	0.00229642	0.0802089	520.00	7.89857	
169	18.590	0.00229653	0.0797215	520.00	7.90844	
170	18.690	0.00229665	0.0792411	520.00	8.08781	
171	18.790	0.00229678	0.0787675	520.00	8.18796	
172	18.890	0.00229691	0.0783007	520.00	8.28785	
173	18.990	0.0022v704	0.0778408	520.00	8.38364	
174	19.090	0.00229718	0.0773877	520.00	8.43721	
175	19.190	0.00229733	0.0769412	520.00	8.51824	
176	19.290	0.00229748	0.0765013	520.00	8.59668	
177	19.390	0.00229763	0.0760680	520.00	8.67254	
178	19.490	0.00229779	0.0756408	520.00	8.68636	
179	19.590	0.00229796	0.0752198	520.00	8.84967	
180	19.690	0.00229813	0.0748047	520.00	8.92832	
181	19.790	0.00229830	0.0743953	520.00	9.00529	
182	19.890	0.00229849	0.0739913	520.00	9.08059	
183	19.990	0.00229867	0.0735928	520.00	9.12959	
184	20.090	0.00229886	0.0731997	520.00	9.18820	
185	20.190	0.00229906	0.0728118	520.00	9.28618	
186	20.290	0.00229926	0.0724291	520.00	9.28937	
187	20.390	0.00229946	0.0720514	520.00	9.33196	
188	20.490	0.00229967	0.0716787	520.00	9.37592	
189	20.590	0.00229989	0.0713107	520.00	9.41703	
190	20.690	0.00230010	0.0709476	520.00	9.48658	
191	20.790	0.00230033	0.0705892	520.00	9.49167	
192	20.890	0.00230055	0.0702353	520.00	9.52670	
193	20.990	0.00230079	0.0698861	520.00	9.55630	
194	21.090	0.00230102	0.0695413	520.00	9.58328	
195	21.190	0.00230126	0.0692009	520.00	9.60884	
196	21.290	0.00230151	0.0688648	520.00	9.63140	
197	21.390	0.00230176	0.0685329	520.00	9.65158	
198	21.490	0.00230201	0.0682051	520.00	9.68920	
199	21.590	0.00230226	0.0678812	520.00	9.68426	
200	21.690	0.00230252	0.0675614	520.00	9.69650	
201	21.790	0.00230279	0.0672453	520.00	9.73883	
202	21.890	0.00230306	0.0669331	520.00	9.71836	
203	21.990	0.00230333	0.0666247	520.00	9.71963	
204	22.090	0.00230360	0.0663198	520.00	9.72295	
205	22.190	0.00230388	0.0660186	520.00	9.72825	
206	22.290	0.00230416	0.0657208	520.00	9.73084	
207	22.390	0.00230444	0.0654265	520.00	9.71846	
208	22.490	0.00230473	0.0651355	520.00	9.70852	
209	22.590	0.00230502	0.0648478	520.00	9.6u926	
210	22.690	0.00230532	0.0645633	520.00	9.68760	
211	22.790	0.00230561	0.0642820	520.00	9.67384	
212	22.890	0.00230591	0.0640038	520.00	9.65775	
213	22.990	0.00230621	0.0637287	520.00	9.6u3942	
214	23.090	0.00230652	0.0634566	520.00	9.61891	
215	23.190	0.00230682	0.0631875	520.00	9.59022	
216	23.290	0.00230713	0.0629213	520.00	9.57139	
217	23.390	0.00230745	0.0626580	520.00	9.54644	
218	23.490	0.00230776	0.0623975	520.00	9.51561	
219	23.590	0.00230808	0.0621398	520.00	9.48432	
220	23.690	0.00230840	0.0618848	520.00	9.45120	
221	23.790	0.00230873	0.0616325	520.00	9.41608	
222	23.890	0.00230906	0.0613828	520.00	9.37498	
223	23.990	0.00230939	0.0611357	520.00	9.33005	
224	24.090	0.00230973	0.0608911	520.00	9.29499	
225	24.190	0.00231007	0.0606490	520.00	9.25819	
226	24.290	0.00231041	0.0604094	520.00	9.21145	
227	24.390	0.00231076	0.0601723	520.00	9.16493	
228	24.490	0.00231110	0.0599376	520.00	9.11680	
229	24.590	0.00231145	0.0597053	520.00	9.06650	
230	24.690	0.00231180	0.0594753	520.00	9.01467	
231	24.790	0.00231216	0.0592477	520.00	8.96112	
232	24.890	0.00231253	0.0590224	520.00	8.90589	
233	24.990	0.00231289	0.0587994	520.00	8.84980	
234	25.090	0.00231326	0.0585786	520.00	8.79269	
235	25.190	0.00231363	0.0583600	520.00	8.73339	
236	25.290	0.00231401	0.0581437	520.00	8.68672	
237	25.390	0.00231439	0.0579295	520.00	8.62551	
238	25.490	0.00231478	0.0577175	520.00	8.56080	
239	25.590	0.00231517	0.0575076	520.00	8.47460	
240	25.690	0.00231557	0.0572998	520.00	8.40696	
241	25.790	0.00231597	0.0570940	520.00	8.33789	
242	25.890	0.00231638	0.0568903	520.00	8.26743	
243	25.990	0.00231679	0.0566886	520.00	8.19560	
244	26.090	0.00231721	0.0564888	520.00	8.12244	
245	26.190	0.00231763	0.0562910	520.00	8.06796	
246	26.290	0.00231806	0.0560951	520.00	7.97221	
247	26.390	0.00231849	0.0559012	520.00	7.89519	
248	26.490	0.00231893	0.0557091	520.00	7.81696	
249	26.590	0.00231937	0.0555189	520.00	7.73752	
250	26.690	0.00231982	0.0553306	520.00	7.65692	
251	26.790	0.00232027	0.0551441	520.00	7.57517	
252	26.890	0.00232073	0.0549594	520.00	7.49230	
253	26.990	0.00232119	0.0547765	520.00	7.40835	
254	27.090	0.00232165	0.0545954	520.00	7.32333	
255	27.190	0.00232212	0.0544160	520.00	7.23728	
256	27.290	0.00232259	0.0542383	520.00	7.15022	
257	27.390	0.00232307	0.0540623	520.00	7.06218	
258	27.490	0.00232355	0.0538880	520.00	6.97318	
259	27.590	0.00232404	0.0537153	520.00	6.88326	
260	27.690	0.00232453	0.0535443	520.00	6.79243	
261	27.790	0.00232503	0.0533749	520.00	6.70073	
262	27.890	0.00232553	0.0532071	520.00	6.60817	
263	27.990	0.00232604	0.0530409	520.00	6.51479	
264	28.090	0.00232655	0.0528763	520.00	6.42061	
265	28.190	0.00232707	0.0527132	520.00	6.32565	
266	28.290	0.00232759	0.0525516	520.00	6.22994	
267	28.390	0.00232812	0.0523916	520.00	6.13351	
268	28.490	0.00232865	0.0522330	520.00	6.03639	
269	28.590	0.00232919	0.0520760	520.00	5.93858	
270	28.690	0.00232973	0.0519204	520.00	5.84013	
271	28.790	0.00233028	0.0517663	520.00	5.74105	
272	28.890	0.00233083	0.0516136	520.00	5.64137	
273	28.990	0.00233139	0.0514624	520.00	5.54112	
274	29.090	0.00233195	0.0513126	520.00	5.44031	
275	29.190	0.00233252	0.0511642	520.00	5.33897	
276	29.290	0.00233309	0.0510172	520.00	5.23713	
277	29.390	0.00233367	0.0508716	520.00	5.13481	
278	29.490	0.00233425	0.0507274	520.00	5.03204	
279	29.590	0.00233484	0.0505845	520.00	4.92883	
280	29.690	0.00233543	0.0504429	520.00	4.82520	
281	29.790	0.00233603	0.0503027	520.00	4.72120	
282	29.890	0.00233663	0.0501638	520.00	4.61682	
283	29.990	0.00233724	0.0500262	520.00	4.51211	
284	30.090	0.00233786	0.0498899	520.00	4.40708	
285	30.190	0.00233848	0.0497549	520.00	4.30175	
286	30.290	0.00233911	0.0496212	520.00	4.19614	
287	30.390	0.00233974	0.0494887	520.00	4.09029	
288	30.490	0.00234038	0.0493574	520.00	3.98421	
289	30.590	0.00234102	0.0492274	520.00	3.87791	
290	30.690	0.00234167	0.0490986	520.00	3.77144	
291	30.790	0.00234232	0.0489710	520.00	3.66480	
292	30.890	0.00234298	0.0488446	520.00	3.55802	
293	30.990	0.00234364	0.0487194	520.00	3.45112	
294	31.090	0.00234431	0.0485954	520.00	3.34412	
295	31.190	0.00234498	0.0484725	520.00	3.23704	
296	31.290	0.00234566	0.0483507	520.00	3.12991	
297	31.390	0.00234634	0.0482301	520.00	3.02274	
298	31.490	0.00234703	0.0481106	520.00		

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DATA POINT	TIME (SECS)	ANGLE-OF-ATTACK RATE (RADIAN/SEC)	ALTITUDE (FT)	ALTITUDE RATE (FT/SEC)	ALT. ACCEL. (FT/SEC**2)	VERT. ACCEL. (FT/SEC**2)	ELEV. DEFLECT. (RADIANS)
1	0.0	-0.0036816821	1000.00	0.01	0.89	0.0	0.0
2	0.010	-0.0037770723	1000.00	0.02	0.91	0.0	0.0
3	0.020	-0.0037739828	1000.00	0.03	0.92	0.0	0.0
4	0.030	-0.0037708538	1000.00	0.04	0.94	0.0	0.0
5	0.040	-0.0037677485	1000.00	0.06	0.98	0.0	0.0
6	0.060	-0.0037615316	1000.00	0.08	1.02	0.0	0.0
7	0.080	-0.0037552230	1000.00	0.09	1.06	0.0	0.0
8	0.100	-0.0037491232	1000.01	0.11	1.11	0.0	0.0
9	0.120	-0.0037429316	1000.01	0.13	1.15	0.0	0.0
10	0.140	-0.0037367517	1000.01	0.15	1.19	0.0	0.0
11	0.160	-0.0037244382	1000.02	0.20	1.28	0.0	0.0
12	0.220	-0.0037121794	1000.03	0.26	1.36	0.0	0.0
13	0.260	-0.0037000078	1000.04	0.31	1.44	0.0	0.0
14	0.300	-0.0036879321	1000.05	0.37	1.52	0.0	0.0
15	0.340	-0.0036759564	1000.07	0.42	1.61	0.0	0.0
16	0.420	-0.0036524218	1000.11	0.57	1.78	0.0	0.0
17	0.500	-0.0036294866	1000.16	0.72	1.94	0.0	0.0
18	0.580	-0.0036072819	1000.22	0.88	2.11	0.0	0.0
19	0.660	-0.0035854501	1000.30	1.04	2.27	0.0	0.0
20	0.740	-0.0035638645	1000.39	1.20	2.42	0.0	0.0
21	0.820	-0.0035411747	1000.53	1.50	2.62	0.0	0.0
22	0.900	-0.0035187215	1000.69	1.77	2.80	0.0	0.0
23	1.000	-0.0034981535	1000.88	2.06	2.99	0.0	0.0
24	1.100	-0.0034779813	1001.18	2.38	3.17	0.0	0.0
25	1.240	-0.0034531764	1001.64	2.80	3.34	0.0	0.0
26	1.380	-0.0034298720	1002.29	3.23	3.51	0.0	0.0
27	1.460	-0.0034170583	1002.96	3.39	3.67	0.0	0.0
28	1.540	-0.0034046867	1003.88	3.76	3.82	0.0	0.0
29	1.600	-0.0033953871	1004.72	4.15	3.97	0.0	0.0
30	1.760	-0.0033734686	1005.18	4.56	4.12	0.0	0.0
31	1.860	-0.0033638280	1007.63	4.98	4.25	0.0	0.0
32	1.960	-0.0033529105	1009.15	5.41	4.38	0.0	0.0
33	2.060	-0.0033430889	1010.71	5.85	4.50	0.0	0.0
34	2.160	-0.0033348902	1012.31	6.31	4.62	0.0	0.0
35	2.260	-0.0033262026	1013.97	6.78	4.73	0.0	0.0
36	2.360	-0.0033184688	1016.68	7.26	4.82	0.0	0.0
37	2.460	-0.0033110923	1017.43	7.74	4.92	0.0	0.0
38	2.560	-0.0033037807	1018.23	8.24	5.00	0.0	0.0
39	2.660	-0.0032971267	1019.07	8.74	5.07	0.0	0.0
40	2.760	-0.0032907861	1019.97	9.25	5.14	0.0	0.0
41	2.860	-0.0032835999	1020.92	9.77	5.20	0.0	0.0
42	2.960	-0.0032781812	1021.93	10.29	5.25	0.0	0.0
43	3.060	-0.0032736718	1022.98	10.82	5.29	0.0	0.0
44	3.160	-0.0032708235	1024.06	11.35	5.32	0.0	0.0
45	3.260	-0.0032682503	1025.25	11.88	5.35	0.0	0.0
46	3.360	-0.0032656813	1026.47	12.42	5.37	0.0	0.0
47	3.460	-0.0032630915	1027.74	12.96	5.37	0.0	0.0
48	3.560	-0.0032604904	1029.06	13.49	5.37	0.0	0.0
49	3.660	-0.0032578544	1030.44	14.03	5.37	0.0	0.0
50	3.760	-0.0032557789	1031.87	14.57	5.35	0.0	0.0
51	3.860	-0.0032531674	1033.35	15.10	5.32	0.0	0.0
52	3.960	-0.0032510488	1034.89	15.61	5.29	0.0	0.0
53	4.060	-0.0032489882	1036.48	16.10	5.25	0.0	0.0
54	4.160	-0.0032476201	1038.12	16.58	5.23	0.0	0.0
55	4.260	-0.0032463249	1039.81	17.20	5.15	0.0	0.0
56	4.360	-0.0032446132	1041.56	17.71	5.09	0.0	0.0
57	4.460	-0.0032433293	1043.36	18.22	5.01	0.0	0.0
58	4.560	-0.0032421233	1045.20	18.71	4.93	0.0	0.0
59	4.660	-0.0032408552	1047.10	19.23	4.86	0.0	0.0
60	4.760	-0.0032396752	1049.04	19.66	4.79	0.0	0.0
61	4.860	-0.0032384920	1051.03	20.15	4.68	0.0	0.0
62	4.960	-0.0032373386	1053.07	20.61	4.55	0.0	0.0
63	5.060	-0.0032361872	1055.15	21.06	4.43	0.0	0.0
64	5.160	-0.0032349793	1057.28	21.53	4.32	0.0	0.0
65	5.260	-0.0032338237	1059.46	21.92	4.19	0.0	0.0
66	5.360	-0.0032327965	1061.67	22.34	4.06	0.0	0.0
67	5.460	-0.0032316192	1063.92	22.74	3.93	0.0	0.0
68	5.560	-0.0032305982	1066.21	23.12	3.79	0.0	0.0
69	5.660	-0.0032295230	1068.54	23.49	3.66	0.0	0.0
70	5.760	-0.0032284057	1070.91	23.85	3.53	0.0	0.0
71	5.860	-0.0032273794	1073.31	24.19	3.38	0.0	0.0
72	5.960	-0.0032263177	1075.75	24.52	3.16	0.0	0.0
73	6.060	-0.0032253330	1078.22	24.83	3.02	0.0	0.0
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75	6.260	-0.0032231554	1083.26	25.40	2.69	0.0	0.0
76	6.360	-0.0032220352	1085.82	25.66	2.51	0.0	0.0
77	6.460	-0.0032209723	1088.41	25.90	2.36	0.0	0.0
78	6.560	-0.0032200344	1091.03	26.13	2.18	0.0	0.0
79	6.660	-0.0032188034	1093.68	26.33	1.98	0.0	0.0
80	6.760	-0.0032176304	1096.36	26.52	1.79	0.0	0.0
81	6.860	-0.0032165908	1099.06	26.69	1.61	0.0	0.0
82	6.960	-0.0032154281	1101.78	26.86	1.42	0.0	0.0
83	7.060	-0.0032143589	1104.53	26.98	1.23	0.0	0.0
84	7.160	-0.0032132853	1107.30	27.09	1.04	0.0	0.0
85	7.260	-0.0032121023	1110.09	27.18	0.85	0.0	0.0
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87	7.460	-0.0032099882	1115.74	27.32	0.46	0.0	0.0
88	7.560	-0.0032089229	1118.59	27.35	0.27	0.0	0.0
89	7.660	-0.0032078227	1121.46	27.37	0.07	0.0	0.0
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101	8.860	-0.0031954097	1156.64	26.06	-2.23	0.0	0.0
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112	9.960	-0.0031839507	1188.62	22.52	-4.17	0.0	0.0
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120	10.760	-0.0031751399	1210.88	18.69	-5.38	0.0	0.0
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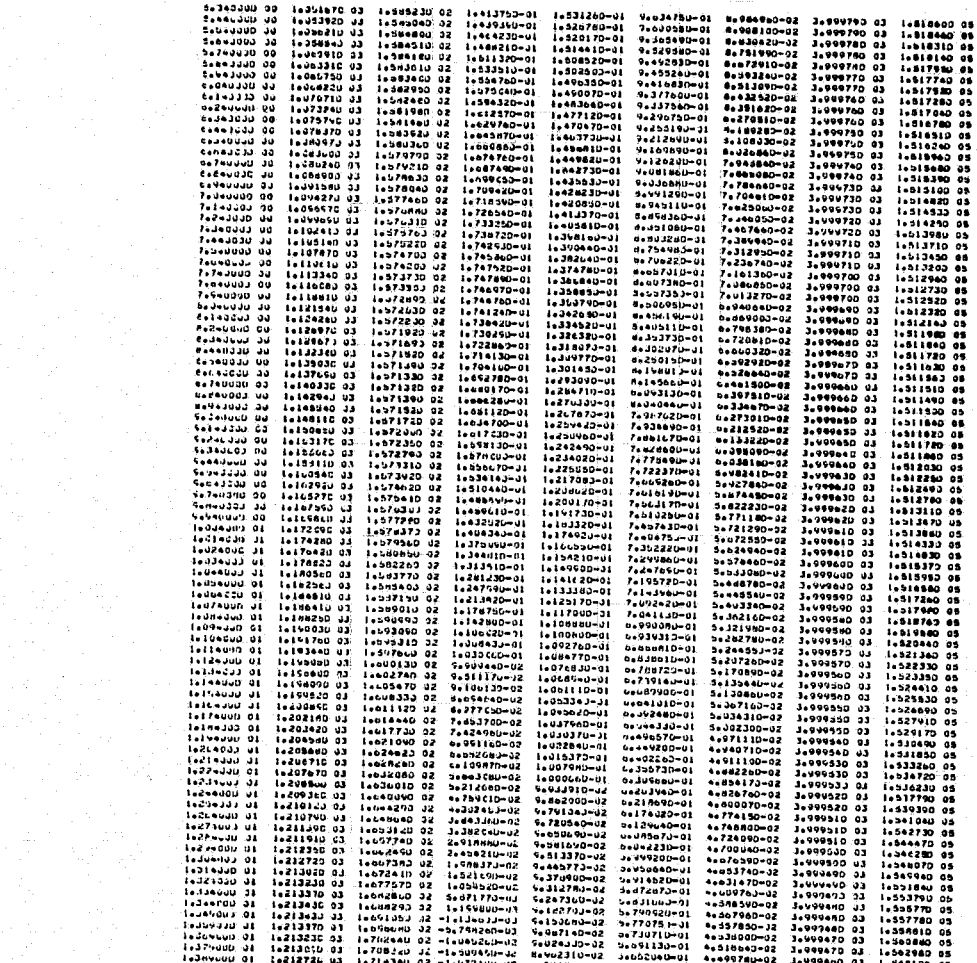
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268	25.490	-0.000350373	791.96	-42.29	4.58	0.0	0.0
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273	25.990	-0.000149201	771.35	-39.84	5.24	0.0	0.0
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277	26.390	-0.000169511	755.89	-37.64	5.73	0.0	0.0
278	26.490	-0.000207535	752.16	-37.06	5.85	0.0	0.0
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280	26.690	-0.000327314	744.86	-35.87	6.09	0.0	0.0
281	26.790	-0.000409822	741.30	-35.26	6.20	0.0	0.0
282	26.890	-0.000507732	737.81	-34.63	6.31	0.0	0.0
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288	27.490	-0.001411187	718.21	-30.65	6.94	0.0	0.0
289	27.590	-0.001610473	715.18	-29.95	7.04	0.0	0.0
290	27.690	-0.001821729	712.22	-29.24	7.14	0.0	0.0
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292	27.890	-0.002270013	706.51	-27.79	7.32	0.0	0.0
293	27.990	-0.002516703	703.77	-27.05	7.41	0.0	0.0
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295	28.190	-0.003018715	698.51	-25.56	7.58	0.0	0.0
296	28.290	-0.003277213	695.96	-24.80	7.66	0.0	0.0
297	28.390	-0.003535876	693.55	-24.03	7.74	0.0	0.0
298	28.490	-0.003801821	691.12	-23.25	7.81	0.0	0.0

ESTIMATED SPECIFIC FUEL CONSUMPTION = 2.561314041722D-07 LBF/(FT-LBF/SEC)/SEC

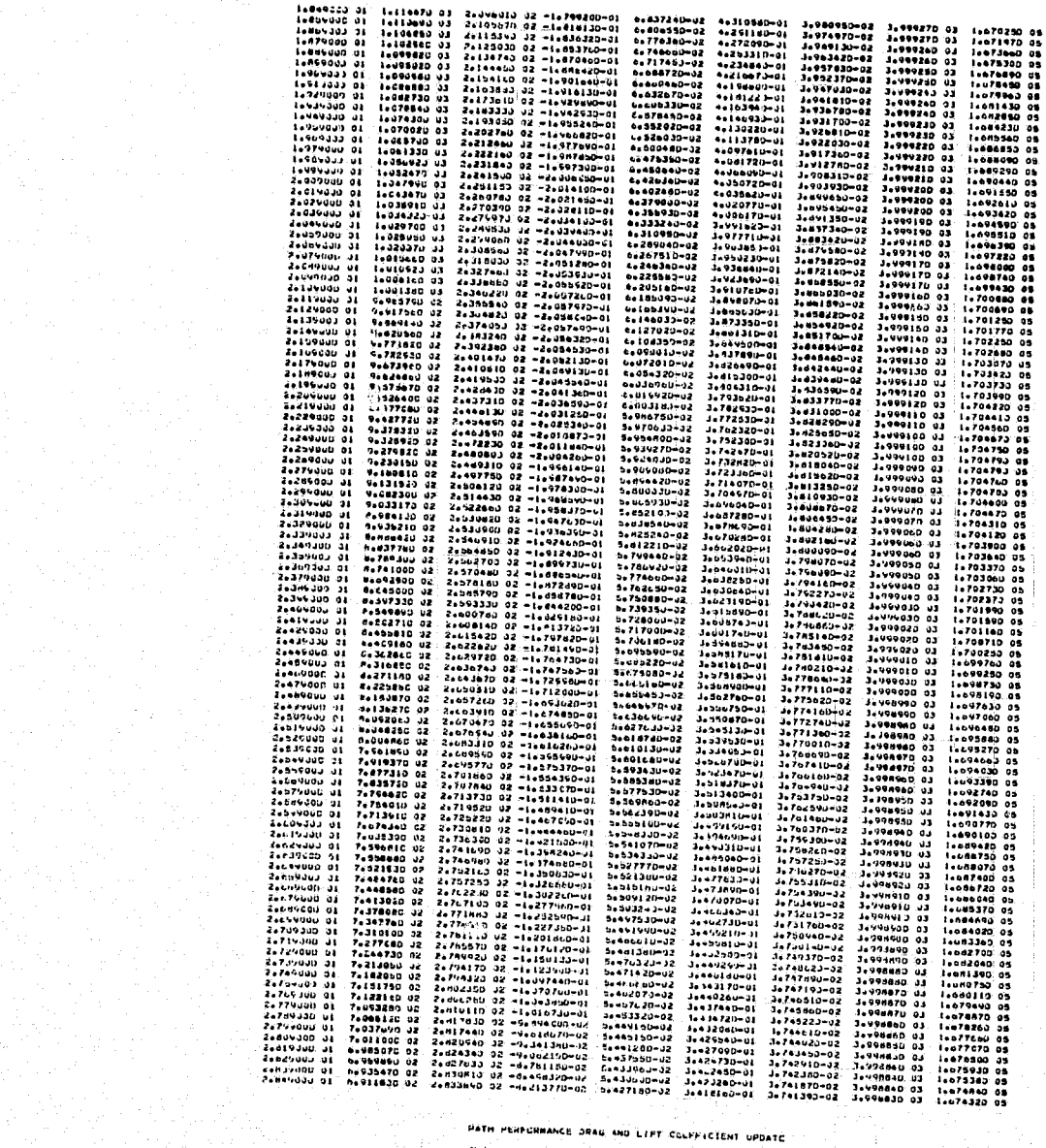
PATH PERFORMANCE ANALYSIS ITERATION NO. 1
(ALTITUDE AND AIRSPEED ASSUMED CORRECT)

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.000000 03	1.467340 02	5.147430-05	1.629430-01	1.024610 00	1.055590-01	4.000000 03	1.466820 05
1.000000-02	1.000000 03	1.467863 02	1.128330-04	1.629450-01	1.024660 00	1.055713-01	4.000000 03	1.467040 05
2.000000-02	1.000000 03	1.468320 02	1.756700-04	1.629500-01	1.024700 00	1.055830-01	4.000000 03	1.467270 05
3.000000-02	1.000000 03	1.468793 02	2.356310-04	1.629520-01	1.024743 00	1.055963-01	4.000000 03	1.467493 05
4.000000-02	1.000000 03	1.469250 02	3.050000-04	1.629690-01	1.024780 00	1.056080-01	4.000000 03	1.467710 05
6.000000-02	1.000000 03	1.470180 02	4.413460-04	1.629720-01	1.024870 00	1.056320-01	4.000000 03	1.468150 05
8.000000-02	1.000003 03	1.471133 02	5.827190-04	1.629650-01	1.024950 00	1.056560-01	4.000000 03	1.468590 05
1.000000-01	1.000010 03	1.472020 02	7.257180-04	1.629940-01	1.025030 00	1.056790-01	4.000000 03	1.469030 05
1.200000-01	1.000010 03	1.472940 02	4.926440-04	1.630113-01	1.025113 00	1.057023-01	3.999993 03	1.469470 05
1.400000-01	1.000013 03	1.473863 02	1.040760-03	1.630240-01	1.025190 00	1.057250-01	3.999990 03	1.469913 05
1.807300-01	1.000020 03	1.475690 02	1.376100-03	1.630490-01	1.025360 00	1.057700-01	3.999990 03	1.470780 05
2.213000-01	1.000033 03	1.477513 02	1.729750-03	1.630733-01	1.025490 00	1.058160-01	3.999990 03	1.471640 05
2.813333-01	1.000040 03	1.479310 02	2.137470-03	1.630960-01	1.025643 00	1.058570-01	3.999990 03	1.472490 05
3.000000-01	1.000050 03	1.481113 02	2.507213-03	1.631193-01	1.025781 00	1.058983-01	3.999993 03	1.473343 05
3.443600-01	1.000070 03	1.482890 02	2.928250-03	1.631410-01	1.025920 00	1.059380-01	3.999990 03	1.474180 05
4.473000-01	1.000110 03	1.484620 02	3.833320-03	1.631820-01	1.026183 00	1.060130-01	3.999980 03	1.475840 05
5.003000-01	1.000160 03	1.486910 02	4.826103-03	1.632210-01	1.026410 00	1.060830-01	3.999980 03	1.477480 05
5.943000-01	1.000220 03	1.489350 02	5.400170-03	1.632560-01	1.026630 00	1.061460-01	3.999970 03	1.479080 05
6.443000-01	1.000300 03	1.490750 02	7.053323-03	1.632873-01	1.026803 00	1.062030-01	3.999970 03	1.480663 05
7.443333-01	1.000390 03	1.503070 02	8.249660-03	1.633130-01	1.027000 00	1.062540-01	3.999970 03	1.482210 05
8.443333-01	1.000530 03	1.504170 02	9.642910-03	1.633440-01	1.027180 00	1.063370-01	3.999960 03	1.484103 05
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3.943333 00	1.024890 03	1.583840 02	9.904090-02	1.592810-01	1.001860 00	9.925350-02	3.999850 03	1.517460 05
4.043333 00	1.026480 03	1.581710 02	1.023390-01	1.589390-01	9.997330-01	9.869280-02	3.999840 03	1.517770 05
4.143333 00	1.028123 03	1.582453 02	1.055127-01	1.585820-01	9.975063-01	9.811110-02	3.999840 03	1.518040 05
4.243333 00	1.029810 03	1.583110 02	1.088560-01	1.582100-01	9.951830-01	9.750990-02	3.999830 03	1.518260 05
4.343333 00	1.031560 03	1.583660 02	1.120670-01	1.578223-01	9.927630-01	9.688990-02	3.999833 03	1.518453 05
4.443333 00	1.033350 03	1.584150 02	1.152380-01	1.574180-01	9.902490-01	9.625200-02	3.999830 03	1.518610 05
4.543333 00	1.035200 03	1.584500 02	1.183660-01	1.570000-01	9.876400-01	9.559710-02	3.999820 03	1.518730 05
4.643333 00	1.037100 03	1.584880 02	1.216500-01	1.565673-01	9.849370-01	9.492590-02	3.999820 03	1.518810 05
4.743333 00	1.039060 03	1.585130 02	1.244810-01	1.561190-01	9.821420-01	9.423950-02	3.999820 03	1.518870 05
4.843333 00	1.041030 03	1.585310 02	1.274570-01	1.556560-01	9.792563-01	9.353860-02	3.999810 03	1.518890 05
4.943333 00	1.043070 03	1.585420 02	1.333750-01	1.551780-01	9.762780-01	9.282430-02	3.999810 03	1.518890 05
5.043333 00	1.045150 03	1.585460 02	1.337290-01	1.546870-01	9.732100-01	9.209730-02	3.999800 03	1.518850 05
5.143333 00	1.047290 03	1.585440 02	1.360160-01	1.541810-01	9.730530-01	9.135870-02	3.999800 03	1.518790 05
5.243333 00	1.049460 03	1.585360 02	1.387320-01	1.536600-01	9.668083-01	9.060910-02	3.999800 03	1.518780 05



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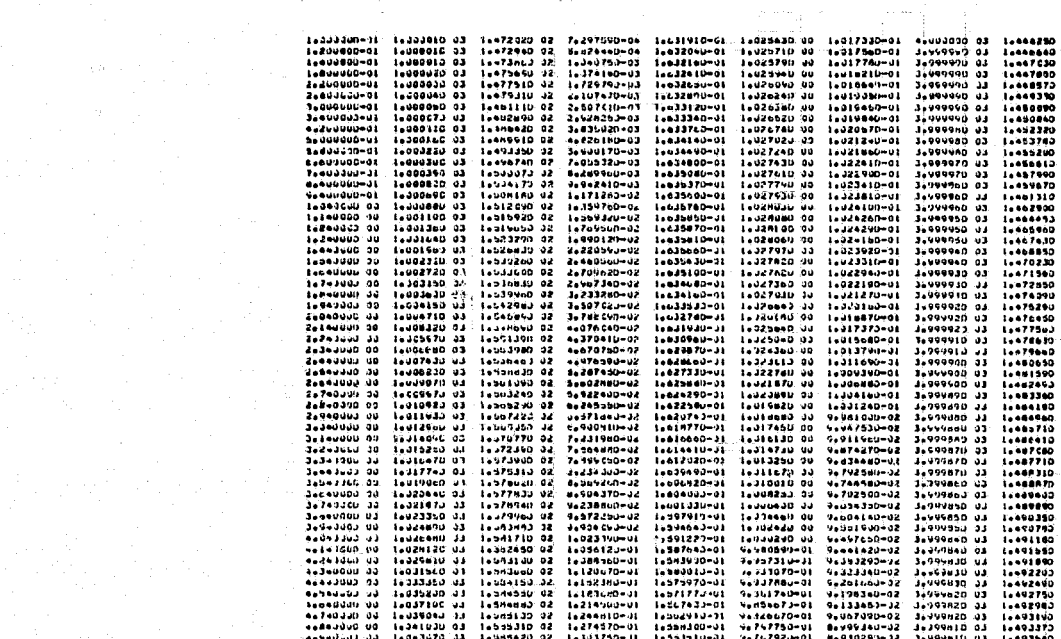


PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

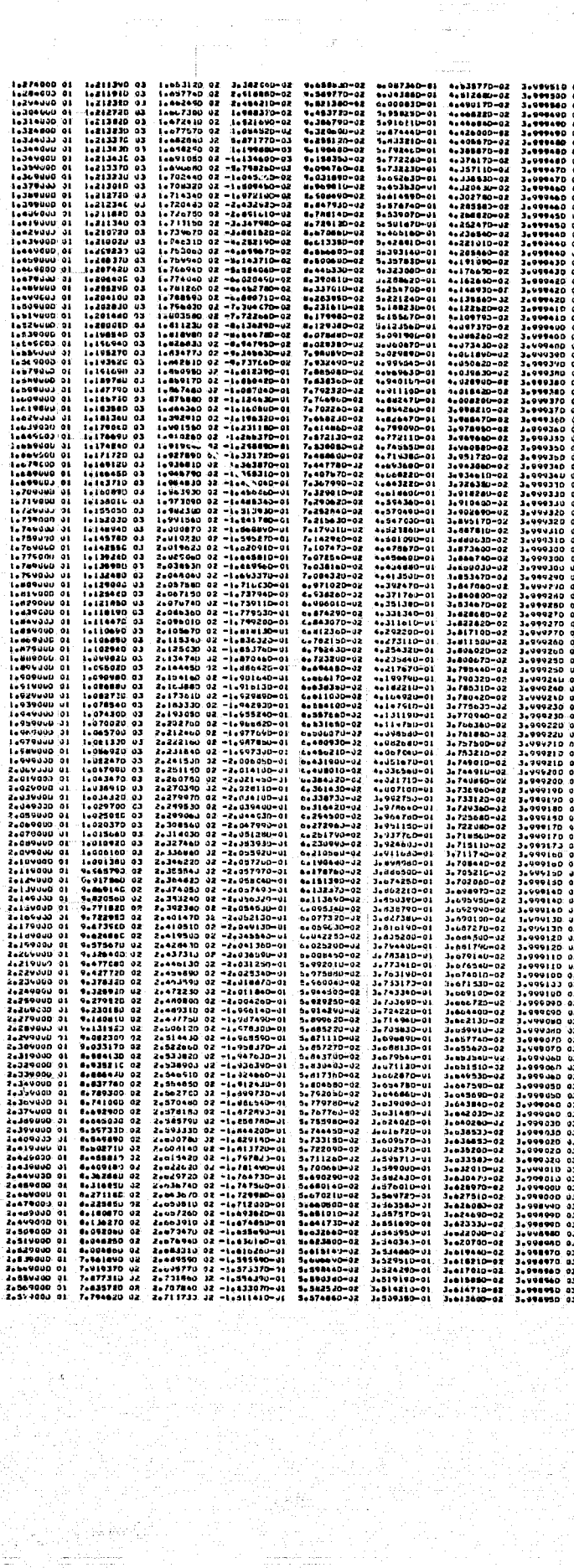
	OLD		DELTA		NEW
CD0 :	9.333e+01	+	-9.131e+01	=	2.022e+01
CD1 :	0.0	+	0.0	=	0.0
CD2 :	5.125e+01	+	-5.388e+01	=	-2.623e+00
CD3 :	0.0	+	0.0	=	0.0
CD4 :	6.281e+01	+	-1.774e+01	=	4.507e+01
CLA1:	-9.391e+01	+	1.359e+01	=	-7.732e+01
CLA2:	1.630e+00	+	-3.132e+00	=	-1.502e+00
CLA3:	-5.257e+01	+	1.137e+01	=	-4.120e+01

PATH PERFORMANCE SUBSTENATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.000e+03	1.467e+03	0.0	1.312e-01	1.259e+00	1.016e-01	4.000e+03	1.444e+06
1.000e-02	1.000e+03	1.467e+03	-1.428e-04	1.313e-01	1.025e+00	1.016e-01	4.000e+03	1.444e+06
2.000e-02	1.000e+03	1.468e+03	-2.856e-04	1.313e-01	1.025e+00	1.016e-01	4.000e+03	1.444e+06
3.000e-02	1.000e+03	1.469e+03	-4.284e-04	1.313e-01	1.025e+00	1.016e-01	4.000e+03	1.444e+06
4.000e-02	1.000e+03	1.469e+03	-5.712e-04	1.313e-01	1.025e+00	1.016e-01	4.000e+03	1.444e+06
5.000e-02	1.000e+03	1.470e+03	-7.140e-04	1.313e-01	1.025e+00	1.016e-01	4.000e+03	1.444e+06



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2.399000 01	7.713910 02	2.725220 02	-1.467090-01	5.560080-02	3.509050-01	3.611470-02	3.998940 03	1.635720 05
2.409000 01	7.672610 02	2.730810 02	-1.444660-01	5.552980-02	3.499800-01	3.610450-02	3.998940 03	1.634720 05
2.419000 01	7.632300 02	2.736300 02	-1.421300-01	5.546050-02	3.491110-01	3.609450-02	3.998930 03	1.633730 05
2.429000 01	7.592880 02	2.741690 02	-1.398240-01	5.539303-02	3.488680-01	3.608440-02	3.998930 03	1.632730 05
2.439000 01	7.554320 02	2.746980 02	-1.374680-01	5.532730-02	3.482660-01	3.607450-02	3.998920 03	1.631740 05
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2.459000 01	7.479520 02	2.757290 02	-1.326960-01	5.520140-02	3.474690-01	3.605540-02	3.998910 03	1.629780 05
2.469000 01	7.443260 02	2.762310 02	-1.302860-01	5.514070-02	3.470860-01	3.604620-02	3.998910 03	1.628810 05
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2.899000 01	6.658600 02	3.227200 02	-8.824000-02	6.450000-02	4.744000-01	6.318000-02	3.998700 03	5.665000 05
2.909000 01	6.696000 02	3.280000 02	-9.700000-02	6.662000-02	5.028000-01	6.865000-02	3.998690 03	6.635000 05
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2.929000 01	6.799000 02	3.412000 02	-1.224000-01	7.224000-02	5.792000-01	8.287000-02	3.998680 03	9.270000 05
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2.969000 01	7.208000 02	3.880000 02	-2.387000-01	9.484000-02	8.918000-01	1.341000-01	3.998660 03	1.907000 06
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3.019000 01	9.161000 02	5.933000 02	-8.513000-01	1.982000-01	2.570000 00	3.760000-01	3.998640 03	6.600000 06

PITCH-ANGLE GAIN = 1.000151672E+00 PITCH-ANGLE BIAS = 8.034502357910-06 RADIAN

MODEL SOLUTIONS

MODEL 12	P0 = 2.607996161517358810D 06	CD0 = 3.323435137304997800-02	
	P1 = 0.0	CD1 = 0.0	
POINT	P2 = 1.618923687853297900 03	CD2 = 1.291837575869796000 00	
FAILURES	P3 = -2.381367036644884100 00	CD3 = 0.0	
= 0	P4 = 3.0	CD4 = 2.303440184976352030 03	

FIT ERROR= 4.614369390544831000-06

MODEL 12 FOUND TO BE BEST FIT

LIFT COEFFICIENTS: BY LEAST SQUARE DISTANCE

CLA0=4.381902639910135640-02
CLA = 0.038617705148942783 01
CLA##=-0.5294916709027443130 00
CAPAA= 0.2055544851952867D 01
CL0= 0.0

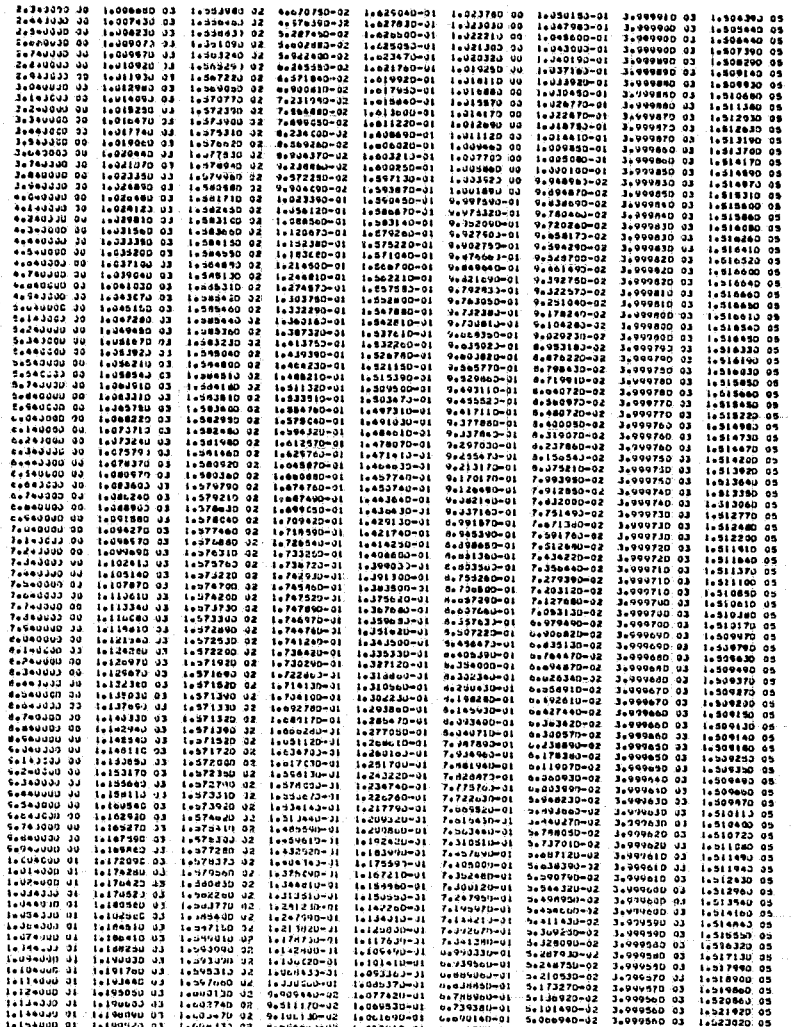
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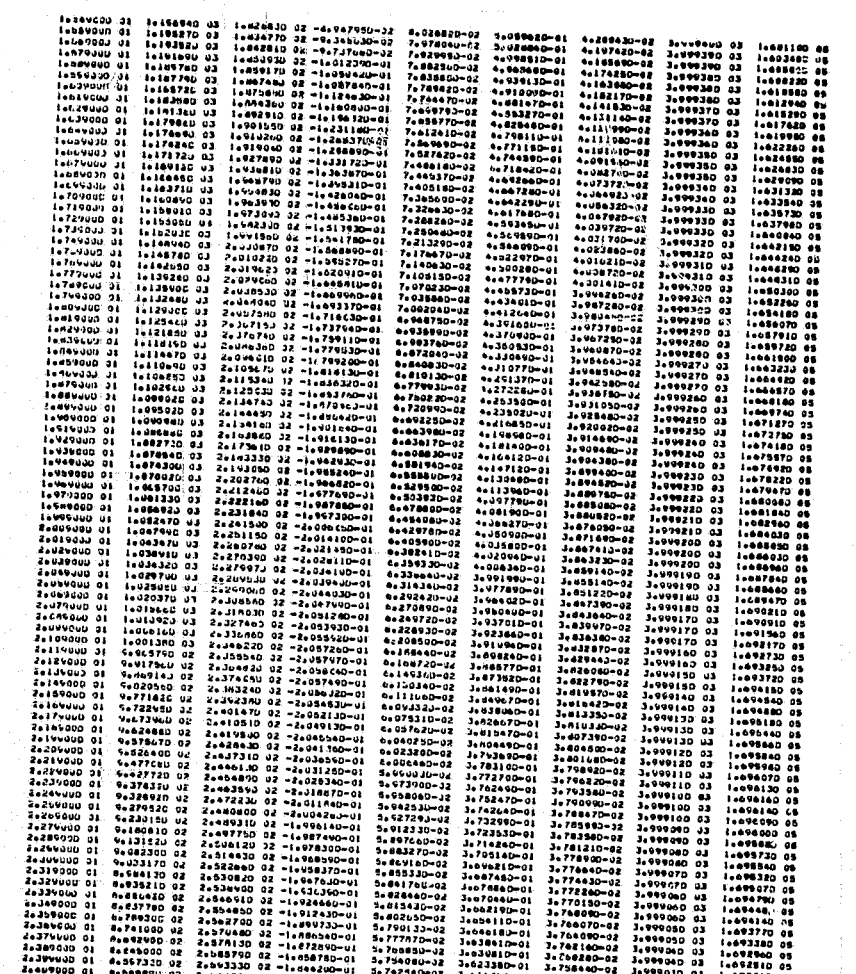
PATH PERFORMANCE ANALYSIS (ITERATION NO. 2
(ALTITUDE AND AIRSPEED ASSUMED CONNECT)

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.000000 03	1.467390 02	0.0	1.630410-01	1.024430 00	1.052620-01	4.000000 03	1.465130 05
1.000000-02	1.000000 03	1.467780 02	1.125330-04	1.630470-01	1.024680 00	1.052750-01	4.000000 03	1.465370 05
2.000000-02	1.000000 03	1.468330 02	1.750760-04	1.630560-01	1.024720 00	1.052870-01	4.000000 03	1.465540 05
3.000000-02	1.000000 03	1.468790 02	2.399510-04	1.630610-01	1.024760 00	1.052890-01	4.000000 03	1.465810 05
4.000000-02	1.000000 03	1.469250 02	3.059650-04	1.630680-01	1.024800 00	1.053120-01	4.000000 03	1.466030 05
5.000000-02	1.000000 03	1.469710 02	3.731480-04	1.630810-01	1.024840 00	1.053360-01	4.000000 03	1.466470 05
6.000000-02	1.000000 03	1.470160 02	4.413480-04	1.630940-01	1.024870 00	1.053600-01	4.000000 03	1.466910 05
7.000000-02	1.000000 03	1.470610 02	5.105360-04	1.631070-01	1.024910 00	1.053830-01	4.000000 03	1.467350 05
8.000000-02	1.000000 03	1.471060 02	5.827180-04	1.631190-01	1.024940 00	1.054060-01	4.000000 03	1.467790 05
9.000000-02	1.000000 03	1.471500 02	6.557390-04	1.631320-01	1.024970 00	1.054300-01	3.999990 03	1.468230 05
1.000000-01	1.000000 03	1.471950 02	7.297190-04	1.631470-01	1.025010 00	1.054540-01	3.999990 03	1.468680 05
1.100000-01	1.000000 03	1.472400 02	8.046540-04	1.631620-01	1.025050 00	1.054780-01	3.999990 03	1.469130 05
1.200000-01	1.000000 03	1.472840 02	8.805790-04	1.631770-01	1.025090 00	1.055020-01	3.999990 03	1.469580 05
1.300000-01	1.000000 03	1.473290 02	9.574750-04	1.631930-01	1.025130 00	1.055260-01	3.999990 03	1.470030 05
1.400000-01	1.000000 03	1.473740 02	1.035410-03	1.632090-01	1.025170 00	1.055510-01	3.999990 03	1.470480 05
1.500000-01	1.000000 03	1.474180 02	1.114130-03	1.632250-01	1.025210 00	1.055760-01	3.999990 03	1.470930 05
1.600000-01	1.000000 03	1.474630 02	1.193660-03	1.632410-01	1.025250 00	1.056010-01	3.999990 03	1.471380 05
1.700000-01	1.000000 03	1.475080 02	1.273990-03	1.632580-01	1.025290 00	1.056260-01	3.999990 03	1.471830 05
1.800000-01	1.000000 03	1.475520 02	1.355120-03	1.632750-01	1.025330 00	1.056510-01	3.999990 03	1.472280 05
1.900000-01	1.000000 03	1.475970 02	1.437040-03	1.632920-01	1.025370 00	1.056770-01	3.999980 03	1.472730 05
2.000000-01	1.000000 03	1.476420 02	1.519750-03	1.633090-01	1.025410 00	1.057030-01	3.999980 03	1.473180 05
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6.000000-01	1.000000 03	1.494280 02	5.463730-03	1.640250-01	1.027010 00	1.068030-01	3.999890 03	1.491180 05
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7.800000-01	1.000000 03	1.502320 02	7.647420-03	1.643490-01	1.027730 00	1.073070-01	3.999830 03	1.499280 05
7.900000-01	1.000000 03	1.502770 02	7.776430-03	1.643670-01	1.027770 00	1.073350-01	3.999830 03	1.499730 05
8.000000-01	1.000000 03	1.503220 02	7.906260-03	1.643850-01	1.027810 00	1.073630-01	3.999820 03	1.500180 05

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OF POOR QUALITY





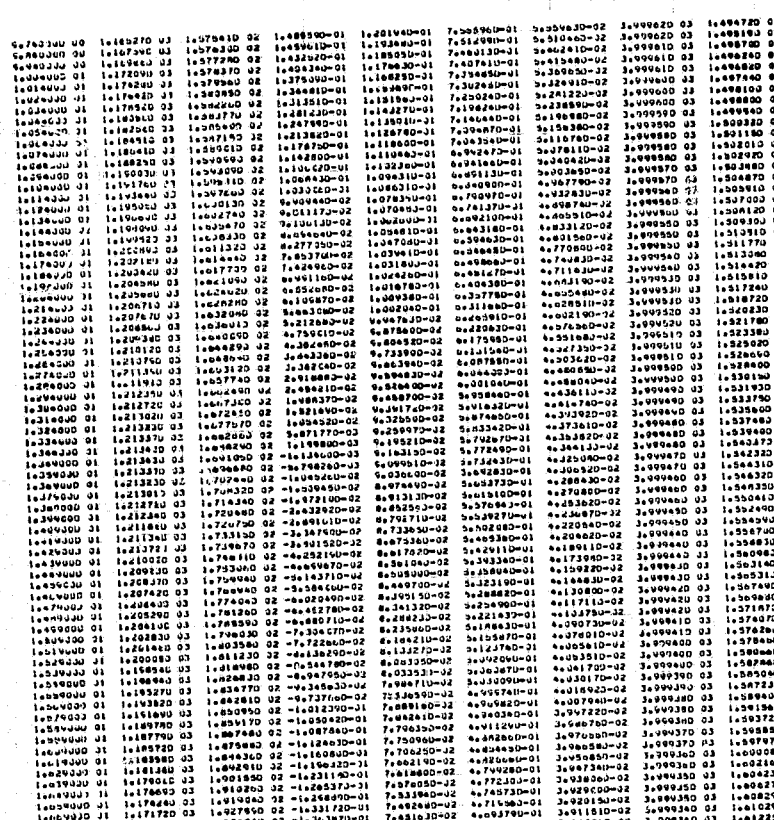
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OF POOR QUALITY

PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

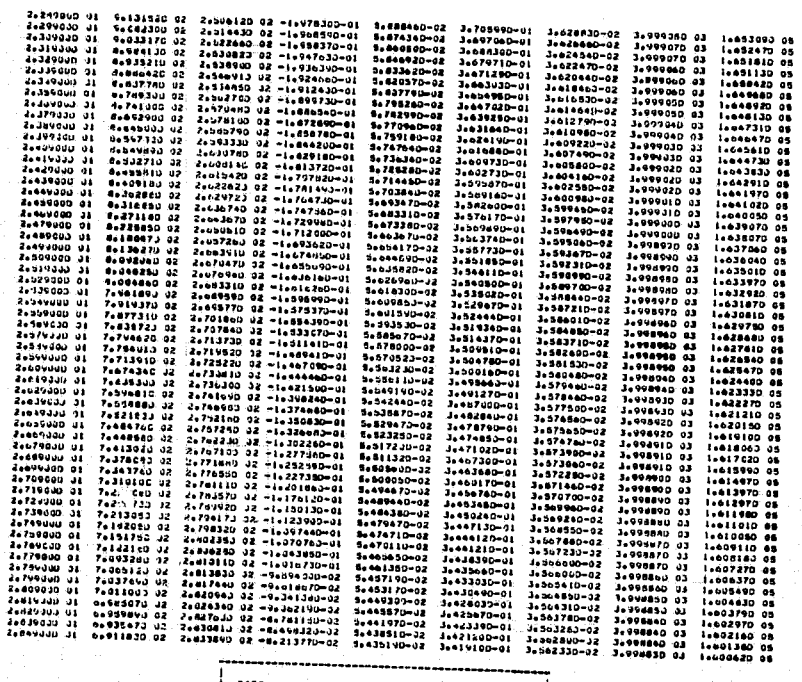
	OLD		DELTA		NEW
CD0 :	0.3323435137048978D-01	+	-0.1311136243310581D-02	=	0.3192321512716920D-01
CD1 :	0.0	+	0.0	=	0.0
CD2 :	0.1291837576979603D 01	+	-0.5617251721103709D-01	=	0.1235665059946623D 01
CM3 :	0.0	+	0.0	=	0.0
CD4 :	0.2034461647935263D 04	+	-0.7849270123984668D 02	=	0.1933096894601841D 04
CLA0:	-0.3519065399163886D-02	+	-0.1363593182976493D-03	=	-0.3654424717461278D-02
CLA :	0.6598177051865278D 01	+	-0.1319581560180386D-02	=	0.6638285767028509D 01
CLAX:	-0.5294710798927823D 00	+	-0.1013161938602372D-01	=	-0.6390232989707231D 00

PATH PERFORMANCE SUBITERATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.000000 03	1.467330 02	5.182630D-05	1.632310D-01	1.025239 00	1.013720D-01	4.000000 03	1.442900 05
1.000000D-02	1.000000 03	1.467800 02	1.128330D-04	1.632380D-01	1.025270 00	1.013840D-01	4.000000 03	1.443100 05
2.000000D-02	1.000000 03	1.468320 02	1.750760D-04	1.632450D-01	1.025310 00	1.013960D-01	4.000000 03	1.443290 05
3.000000D-02	1.000000 03	1.468790 02	2.349910D-04	1.632520D-01	1.025350 00	1.014080D-01	4.000000 03	1.443490 05
4.000000D-02	1.000000 03	1.469250 02	3.098560D-04	1.632580D-01	1.025390 00	1.014190D-01	4.000000 03	1.443690 05
6.000000D-02	1.000000 03	1.470140 02	4.613440D-04	1.632720D-01	1.025480 00	1.014430D-01	4.000000 03	1.444080 05
8.000000D-02	1.000000 03	1.471100 02	3.827160D-04	1.632850D-01	1.025560 00	1.014660D-01	4.000000 03	1.444473 05
1.000000D-01	1.000010 03	1.472020 02	7.257590D-04	1.632980D-01	1.025640 00	1.014890D-01	4.000000 03	1.444860 05
1.200000D-01	1.000010 03	1.472940 02	8.826440D-04	1.633110D-01	1.025720 00	1.015110D-01	3.999990 03	1.445250 05
1.400000D-01	1.000010 03	1.473860 02	1.040750D-03	1.633240D-01	1.025800 00	1.015340D-01	3.999990 03	1.445640 05
1.800000D-01	1.000021 03	1.475650 02	1.374160D-03	1.633490D-01	1.025960 00	1.015770D-01	3.999990 03	1.446410 05
2.200000D-01	1.000020 03	1.477510 02	1.720790D-03	1.633730D-01	1.026110 00	1.016200D-01	3.999990 03	1.447173 05
2.600000D-01	1.000040 03	1.479310 02	2.107670D-03	1.633980D-01	1.026250 00	1.016610D-01	3.999990 03	1.447930 05
3.000000D-01	1.000050 03	1.481110 02	2.507010D-03	1.634190D-01	1.026400 00	1.017010D-01	3.999990 03	1.448680 05
3.400000D-01	1.000073 03	1.482893 02	2.928250D-03	1.634413D-01	1.026533 00	1.017430D-01	3.999990 03	1.449430 05
4.200000D-01	1.000110 03	1.486420 02	3.815020D-03	1.634930D-01	1.026790 00	1.018130D-01	3.999980 03	1.450900 05
5.000000D-01	1.000160 03	1.489913 02	4.826143D-03	1.635220D-01	1.027030 00	1.018810D-01	3.999980 03	1.452340 05
5.800000D-01	1.000220 03	1.493350 02	5.903170D-03	1.635570D-01	1.027250 00	1.019430D-01	3.999980 03	1.453760 05
6.600000D-01	1.000300 03	1.496740 02	7.036320D-03	1.635880D-01	1.027480 00	1.019980D-01	3.999970 03	1.455160 05
7.400000D-01	1.000393 03	1.500073 02	8.259763D-03	1.636160D-01	1.027620 00	1.020470D-01	3.999970 03	1.456533 05
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9.000000D-01	1.000690 03	1.506193 02	1.171280D-02	1.636083D-01	1.027543 00	1.021390D-01	3.999960 03	1.459423 05
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4.340000 00	1.031560 03	1.583600 02	1.120670D-01	1.581040D-01	9.933270D-01	9.297130D-02	3.999830 03	1.490340 05
4.440000 00	1.033353 03	1.584153 02	1.152363D-01	1.576990D-01	9.908081D-01	9.235320D-02	3.999830 03	1.490620 05
4.540000 00	1.035200 03	1.584550 02	1.183630D-01	1.572530D-01	9.881960D-01	9.171850D-02	3.999820 03	1.490860 05
4.640000 00	1.037100 03	1.584880 02	1.214400D-01	1.568450D-01	9.854870D-01	9.106830D-02	3.999823 03	1.491093 05
4.740000 00	1.039040 03	1.585130 02	1.244610D-01	1.563950D-01	9.826880D-01	9.040330D-02	3.999820 03	1.491280 05
4.840000 00	1.041030 03	1.585310 02	1.274570D-01	1.559310D-01	9.797960D-01	8.972430D-02	3.999810 03	1.491460 05
4.940000 00	1.043075 03	1.585423 02	1.303753D-01	1.554520D-01	9.768130D-01	8.903240D-02	3.999810 03	1.491610 05
5.040000 00	1.045150 03	1.585460 02	1.332250D-01	1.549580D-01	9.737400D-01	8.832830D-02	3.999800 03	1.491740 05
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5.240000 00	1.049450 03	1.585360 02	1.347720D-01	1.539290D-01	9.673270D-01	8.688700D-02	3.999800 03	1.491950 05
5.340000 00	1.051670 03	1.585230 02	1.413750D-01	1.533930D-01	9.639890D-01	8.615160D-02	3.999790 03	1.492020 05
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5.740000 00	1.060910 03	1.584180 02	1.511320D-01	1.511120D-01	9.497750D-01	8.313040D-02	3.999780 03	1.492150 05
5.840000 00	1.063310 03	1.583810 02	1.533510D-01	1.505070D-01	9.460100D-01	8.235960D-02	3.999770 03	1.492150 05
5.940000 00	1.065750 03	1.583400 02	1.554760D-01	1.498900D-01	9.421630D-01	8.158360D-02	3.999770 03	1.492140 05
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6.340000 00	1.075790 03	1.581400 02	1.629760D-01	1.472940D-01	9.259760D-01	7.845050D-02	3.999750 03	1.491990 05
6.440000 00	1.078373 03	1.580920 02	1.645873D-01	1.466150D-01	9.217400D-01	7.766460D-02	3.999750 03	1.491940 05
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7.040000 00	1.094270 03	1.577460 02	1.718590D-01	1.423170D-01	8.949270D-01	7.299460D-02	3.999730 03	1.491540 05
7.140000 00	1.096970 03	1.576890 02	1.726540D-01	1.415670D-01	8.902460D-01	7.223100D-02	3.999723 03	1.491480 05
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7.340000 00	1.102410 03	1.575760 02	1.738720D-01	1.400420D-01	8.807260D-01	7.072240D-02	3.999710 03	1.491360 05
7.440000 00	1.105143 03	1.575220 02	1.742930D-01	1.392680D-01	8.758910D-01	6.997850D-02	3.999710 03	1.491310 05
7.540000 00	1.107870 03	1.574700 02	1.745860D-01	1.384860D-01	8.710090D-01	6.924220D-02	3.999710 03	1.491260 05
7.640000 00	1.110610 03	1.574200 02	1.747523D-01	1.376973D-01	8.660820D-01	6.851410D-02	3.999700 03	1.491230 05
7.740000 00	1.113340 03	1.573730 02	1.747890D-01	1.369020D-01	8.611130D-01	6.779450D-02	3.999700 03	1.491200 05
7.840000 00	1.116080 03	1.573300 02	1.746970D-01	1.361000D-01	8.561050D-01	6.708390D-02	3.999700 03	1.491193 05
7.940000 00	1.118810 03	1.572890 02	1.744760D-01	1.352920D-01	8.510590D-01	6.638260D-02	3.999690 03	1.491190 05
8.040000 00	1.121540 03	1.572530 02	1.741240D-01	1.344790D-01	8.459780D-01	6.569100D-02	3.999690 03	1.491200 05
8.140000 00	1.124260 03	1.572233 02	1.736420D-01	1.336610D-01	8.408650D-01	6.500920D-02	3.999680 03	1.491230 05
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8.440000 00	1.132360 03	1.571520 02	1.714130D-01	1.311800D-01	8.253530D-01	6.302640D-02	3.999670 03	1.491410 05
8.540000 00	1.135030 03	1.571390 02	1.704100D-01	1.303450D-01	8.201340D-01	6.238700D-02	3.999670 03	1.491510 05
8.640000 00	1.137690 03	1.571330 02	1.692780D-01	1.295073D-01	8.148940D-01	6.175860D-02	3.999660 03	1.491630 05
8.740000 00	1.140330 03	1.571320 02	1.680170D-01	1.286670D-01	8.096360D-01	6.114130D-02	3.999660 03	1.491770 05
8.840000 00	1.142940 03	1.571390 02	1.666280D-01	1.278240D-01	8.043620D-01	6.053530D-02	3.999650 03	1.491943 05
8.940000 00	1.145840 03	1.571520 02	1.651120D-01	1.269790D-01	7.990750D-01	5.994070D-02	3.999650 03	1.492130 05
9.040000 00	1.148110 03	1.571720 02	1.634700D-01	1.261320D-01	7.937760D-01	5.935740D-02	3.999650 03	1.492350 05
9.140000 00	1.150650 03	1.572000 02	1.617030D-01	1.252850D-01	7.884720D-01	5.878570D-02	3.999650 03	1.492600 05
9.240000 00	1.153170 03	1.572350 02	1.598130D-01	1.244360D-01	7.831600D-01	5.822550D-02	3.999640 03	1.492870 05
9.340000 00	1.155660 03	1.572790 02	1.578000D-01	1.235870D-01	7.778440D-01	5.767673D-02	3.999640 03	1.493180 05
9.440000 00	1.158110 03	1.573310 02	1.556670D-01	1.227380D-01	7.725280D-01	5.713950D-02	3.999630 03	1.493510 05
9.540000 00	1.160540 03	1.573920 02	1.534140D-01	1.218890D-01	7.672130D-01	5.661370D-02	3.999630 03	1.493880 05
9.640000 00	1.162920 03	1.574620 02	1.513440D-01	1.210410D-01	7.619010D-01	5.609930D-02	3.999630 03	1.494280 05



ORIGINAL PAGE IS
OF POOR QUALITY



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 PITCH-ANGLE GAIN =  1.0000000000000 00
 PITCH-ANGLE BIAS =  3.0047989909170-17 RADIAN
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MODEL SOLUTIONS

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 MODEL 12    PO =  4.8554845252226B8200 04     CD0 =  3.4V9507043654811100-02
             P1 =  0.0                         CD1 =  0.0
 FCINT       P2 =  1.1290963061038A6100 03     CD2 =  1.3114079594210400 00
 FAILURES    P3 = -4.1816590331312A2400 00     CD3 =  0.0
   0         P4 =  0.0                         CD4 =  4.9586493553706B2800 03

 FIT ERROR=  7.0034A0871161V21V000-09
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MODEL 12 FOUND TO BE BEST FIT

LIFT COEFFICIENTS BY LEAST SQUARE DISTANCE

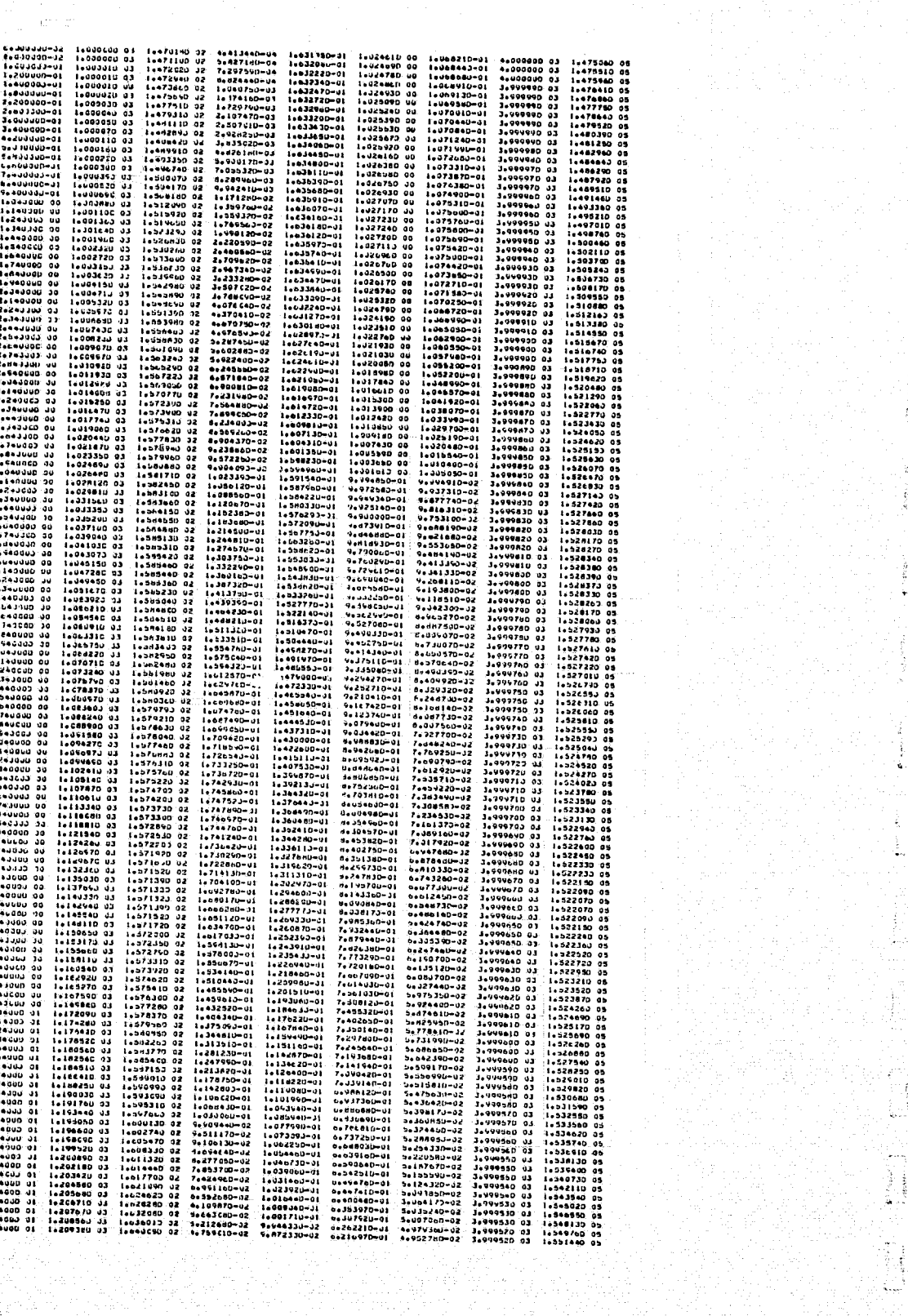
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 CLA4=0.3495004620363J4163 00
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ESTIMATED SPECIFIC FUEL CONSUMPTION = 4.5271E0U3383907D-07 LBF/(FT-LBF/SEC)/SEC

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 PATH PERFORMANCE ANALYSIS ITERATION NO. 3
 (ALTITUDE AND AIRSPEED ASSUMED CORRECT)
```

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.0000000 03	1.4673G0 02	5.1424J0-05	1.0J1650-01	1.024367 00	1.0B7480-01	4.000000 03	1.473690 05
2.0000000-02	1.0000000 03	1.467860 02	1.128330-04	1.0J1620-01	1.024400 00	1.0B7600-01	4.000000 03	1.473925 05
3.0000000-02	1.0000000 03	1.468790 02	2.3999J0-04	1.031750-01	1.024490 00	1.0B7730-01	4.000000 03	1.474150 05
4.0000000-02	1.0000000 03	1.469253 02	3.0B5360-04	1.031820-01	1.024530 00	1.0B7870-01	4.000000 03	1.474380 05



ORIGINAL PAGE IS
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2.8e89d0D 01	7.e335710 02	2.e707840 02	-1.e333070-01	5.e838610-02	3.e51256D-01	3.e908320-02	3.e99d95D 03	1.e743880 05
2.e37e00D 01	7.e78dc20 02	2.e713730 02	-1.e311410-01	5.e87a160-02	3.e927710-01	3.e907150-02	3.e98e95D 03	1.e743860 05
2.e3e900D 01	7.e758010 02	2.e719920 02	-1.e480410-01	5.e888e60-02	3.e928980-01	3.e908010-02	3.e98e95D 03	1.e743830 05
2.e39900D 01	7.e713910 02	2.e725220 02	-1.e4c7c90-01	5.e8e1370-02	3.e93e30-01	3.e904900-02	3.e98e94D 03	1.e743800 05
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2.e6e9900 01	7.e821520 02	2.e752180 02	-1.e3b0d30-01	5.e527b3D-02	3.e9700D-01	3.e8e9780-02	3.e99e92D 03	1.e741670 05
2.e6e9d00 01	7.e86e763 02	2.e757252 02	-1.e32ee80-01	5.e521e10-02	3.e9730D-01	3.e898650-02	3.e99e91D 03	1.e741100 05
2.e6e9d30 01	7.e86eb80 02	2.e762230 02	-1.e3024b0-01	5.e51b30e-02	3.e9e0v26U-01	3.e897630-02	3.e99e91D 03	1.e740730 05
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2.e6e9e00 01	7.e863710 02	2.e776850 02	-1.e227d50-01	5.e498220-02	3.e9e639D-01	3.e895360-02	3.e99e90D 03	1.e739590 05
2.e706d00 01	7.e81010d 02	2.e781110 02	-1.e2018e0-01	5.e492840-02	3.e9e46e0-01	3.e894580-02	3.e99e89D 03	1.e739260 05
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2.e849d00 01	6.e918e30 02	2.e833e90 02	-8.e213770-02	5.e433370-02	3.e9fe3b0-01	3.e886490-02	3.e99e83D 03	1.e733720 05

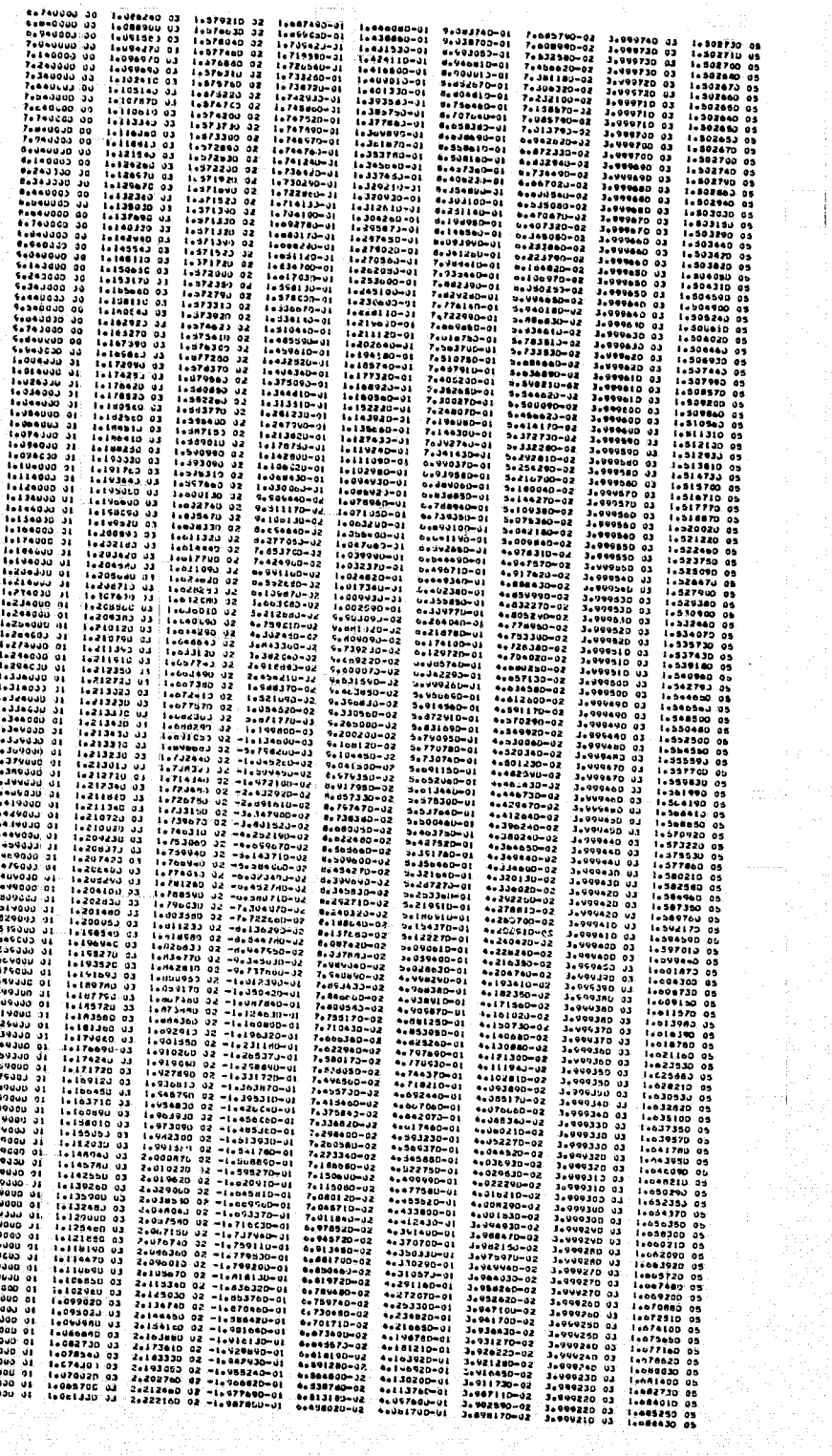
PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

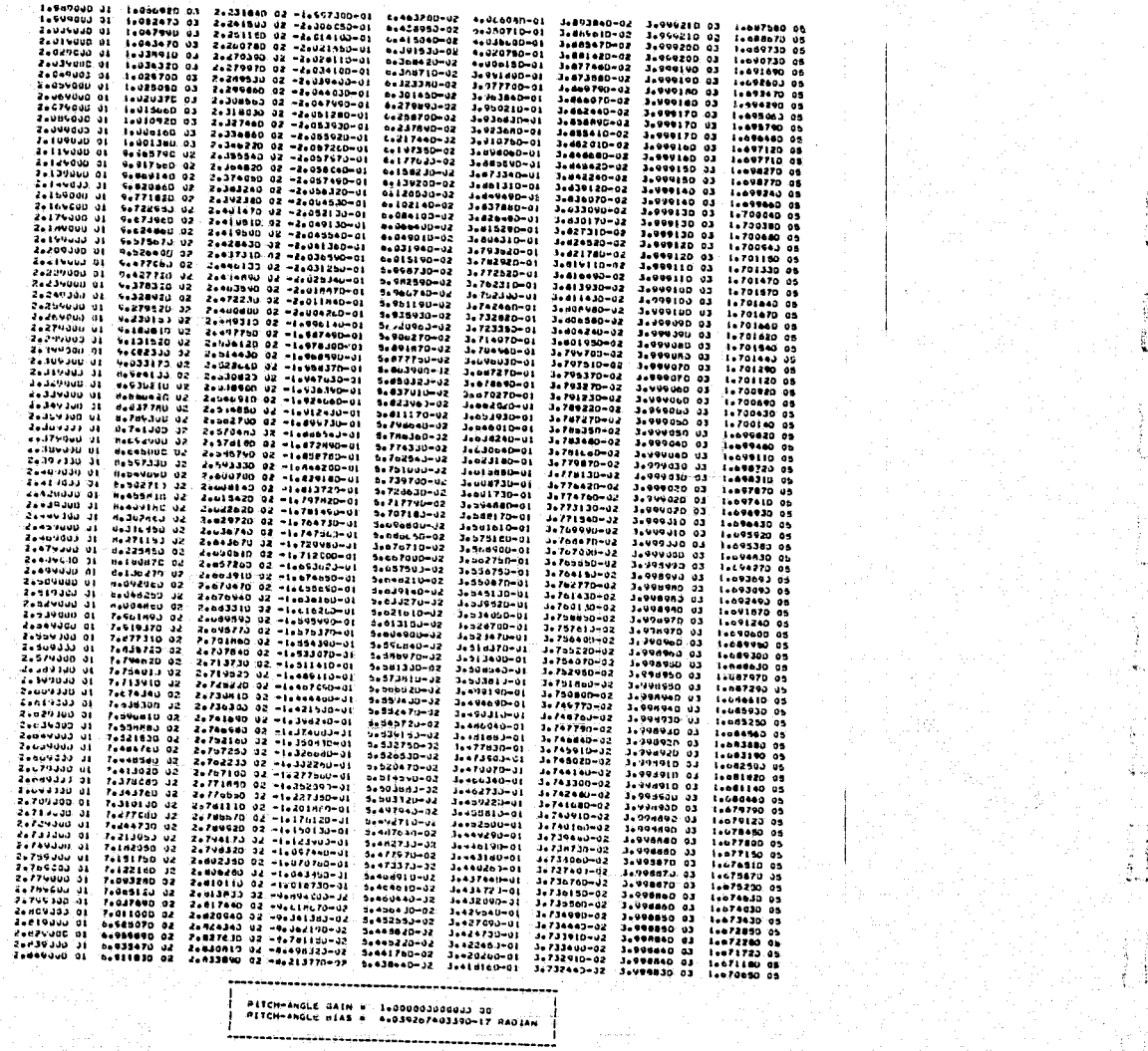
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CD1 :	3.e0	+	3.e0	=	0.e0
CD2 :	9.1311e0765e4821d63 01	+	-3.e0e0332335e0312e680-01	=	9.e125137502e3889840 01
CD3 :	0.e0	+	3.e0	=	3.e0
CD4 :	3.e19be495353708820 00	+	-3.e4e8106b7302e01350 02	=	3.e1e72178e96403673 00
CLA1:	-3.e366e32544e8215982D-02	+	-3.e137eb4ve02220976D-03	=	-3.e3401985616636d8d0-02
CLA :	3.e6d9e0027337128d0 01	+	-3.e1367813e0952361e90-02	=	3.e1381232e95e1736d 01
CLA2:	-3.e8495j08v2006301e3 00	+	-3.e13d034e8573311160-01	=	-3.e5601e30387637270 00

PATH PERFORMANCE SUBITERATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.e0	1.e6d0000 03	1.e67390 02	5.e1e24d0-03	1.e33b70-01	1.e0250d0 00	1.e025390-01	4.e000000 03	1.e44e620 05
1.e0000d0-02	1.e000000 03	1.e6768D 02	1.e128330-04	1.e6J3640-01	1.e0250d0 00	1.e025510-01	4.e000000 03	1.e449820 05
2.e000003-02	1.e000000 03	1.e6en320 02	1.e750760-04	1.e633710-01	1.e0250d0 00	1.e025630-01	4.e000000 03	1.e449820 05
3.e003000-02	1.e000000 03	1.e68e790 02	2.e3995d0-04	1.e633780-01	1.e026130 00	1.e025750-01	4.e000000 03	1.e450030 05
4.e0030d0-02	1.e000000 03	1.e6e9250 02	3.e0586d0-04	1.e6J3850-01	1.e026170 00	1.e025860-01	4.e000030 03	1.e450430 05
5.e003000-02	1.e000000 03	1.e670160 02	4.e413A40-04	1.e633980-01	1.e0252d0 00	1.e025980-01	4.e000300 03	1.e450830 05
6.e0030d0-02	1.e000000 03	1.e671100 02	5.e827180-04	1.e63e110-01	1.e0254d0 00	1.e026320-01	4.e000000 03	1.e451240 05
1.e030000-01	1.e000010 03	1.e672020 02	7.e297590-04	1.e634240-01	1.e0256d0 00	1.e026550-01	4.e000000 03	1.e451640 05
1.e200d00-01	1.e000010 03	1.e672940 02	8.e826e40-04	1.e634370-01	1.e026600 00	1.e026770-01	3.e999e90 03	1.e452040 05
1.e400d00-01	1.e000e1C 03	1.e673860 02	1.e3e0750-03	1.e63e500-01	1.e0265d0 00	1.e026990-01	3.e999e90 03	1.e452e40 05
1.e800300-01	1.e000030 03	1.e675690 02	1.e3741n0-03	1.e63e750-01	1.e026730 00	1.e027420-01	3.e999e90 03	1.e452e30 05
2.e000000-01	1.e000030 03	1.e677510 02	1.e729790-03	1.e6J3900-01	1.e0268d0 00	1.e027640-01	3.e999e90 03	1.e453230 05
2.e000000-01	1.e000e03 03	1.e679330 02	2.e107470-03	1.e63e230-01	1.e026J30 00	1.e027860-01	3.e999e90 03	1.e454e30 05
3.e000d00-01	1.e000080 03	1.e681150 02	2.e307c10-03	1.e63e4e0-01	1.e02e170 00	1.e028e40-01	3.e999e90 03	1.e455560 05
3.e003000-01	1.e000e7C 03	1.e682e62 02	2.e492b30-03	1.e63e6d0-01	1.e026J10 00	1.e029e20-01	3.e999e90 03	1.e456330 05
4.e2J3000-01	1.e000110 03	1.e68e620 02	3.e835c00-03	1.e63e830-01	1.e02eb70 00	1.e029740-01	3.e999e90 03	1.e456330 05
5.e003000-01	1.e000160 03	1.e68e910 02	4.e82e180-03	1.e63e490-01	1.e02e810 00	1.e030e10-01	3.e999e80 03	1.e457e60 05
5.e803300-01	1.e000220 03	1.e693350 02	5.e901170-03	1.e63e460-01	1.e027030 00	1.e031020-01	3.e999e80 03	1.e460330 05
6.e003000-01	1.e000300 03	1.e69e7e0 02	7.e3b3320-03	1.e637150-01	1.e027e20 00	1.e031e60-01	3.e999e70 03	1.e4n0760 05
7.e430000-01	1.e000396 03	1.e700d72 02	8.e8e9e60-03	1.e63743J-01	1.e027e00 00	1.e032050-01	3.e999e70 03	1.e462230 05
8.e430000-01	1.e000530 03	1.e70e170 02	9.e9e4e10-03	1.e6J7730-01	1.e027e80 00	1.e032e60-01	3.e999e70 03	1.e463e60 05
9.e800000-01	1.e000690 03	1.e709480 02	1.e171243-02	1.e63f6e0-01	1.e027720 00	1.e032d50-01	3.e999e60 03	1.e465370 05
1.e040000 00	1.e000903 03	1.e712090 02	1.e397b60-02	1.e638120-01	1.e027420 00	1.e033230-01	3.e999e60 03	1.e467e50 05
1.e140000 00	1.e001100 03	1.e715920 02	1.e3b9320-02	1.e63e210-01	1.e027e80 00	1.e033390-01	3.e999e60 03	1.e4e6e0 05
1.e240000 00	1.e001360 03	1.e719e30 02	1.e3e2d10-02	1.e63e210-01	1.e027e80 00	1.e033390-01	3.e999e50 03	1.e470280 05
1.e340000 00	1.e001640 03	1.e724e90 02	1.e990120-02	1.e63e170-01	1.e027e50 00	1.e033e60-01	3.e999e50 03	1.e471e40 05
1.e440000 00	1.e001960 03	1.e72e830 02	2.e220450-02	1.e635020-01	1.e027e00 00	1.e034220-01	3.e999e50 03	1.e473340 05
1.e5e0000 00	1.e002320 03	1.e730260 02	2.e605b50-02	1.e637700-01	1.e027e20 00	1.e033e80-01	3.e999e40 03	1.e474e10 05
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2.e440000 00	1.e00a670 03	1.e7e6190 02	5.e602fe0-02	1.e62810-01	1.e01e7d0 00	1.e016250-01	3.e999e00 03	1.e489020 05
2.e540000 00	1.e00c750 03	1.e7e3240 02	5.e922e00-02	1.e628e20-01	1.e022n80 00	1.e013570-01	3.e999e00 03	1.e489e10 05
2.e640000 00	1.e010e20 03	1.e7e3290 02	6.e245e50-02	1.e62e910-01	1.e019e20 00	1.e010690-01	3.e999e00 03	1.e490810 05
2.e740000 00	1.e011930 03	1.e7e7220 02	6.e571940-02	1.e623000-01	1.e31e670 00	1.e007590-01	3.e999e80 03	1.e491e40 05
2.e840000 00	1.e012e40 03	1.e7e9e50 02	6.e932e10-02	1.e621e30-01	1.e317e60 00	1.e004290-01	3.e997e80 03	1.e492e40 05
2.e940000 00	1.e014e90 03	1.e7e77J0 02	7.e231980-02	1.e61e960-01	1.e31e930 00	1.e000787-01	3.e996e80 03	1.e493e00 05
3.e040000 00	1.e015e50 03	1.e7e2493 02	7.e5e4660-02	1.e61e710-01	1.e314630 00	9.e970610-02	3.e996e70 03	1.e493e20 05
3.e140000 00	1.e016e70 03	1.e7d3900 02	7.e844e30-02	1.e614320-01	1.e313060 00	9.e93134e-02	3.e996e70 03	1.e494610 05
3.e240000 00	1.e017e40 03	1.e7e5310 02	8.e2d4000-02	1.e611780-01	1.e311463 00	9.e889993-02	3.e996e70 03	1.e495270 05
3.e340000 00	1.e019e00 03	1.e7e6e20 02	8.e596260-02	1.e609100-01	1.e309e00 00	9.e846570-02	3.e996e60 03	1.e495880 05
3.e440000 00	1.e020e4C 03	1.e7e7830 02	8.e9e6370-02	1.e606270-01	1.e308e60 00	9.e81d90-02	3.e996e60 03	1.e496e70 05
3.e540000 00	1.e021e70 03	1.e7e8e43 02	9.e23d9e0-02	1.e603330-01	1.e306190 00	9.e7535e0-02	3.e996e50 03	1.e497320 05
3.e640000 00	1.e023350 03	1.e7e9900 02	9.e572250-02	1.e60170-01	1.e304250 00	9.e704e20-02	3.e996e50 03	1.e497e40 05
3.e740000 00	1.e024e80 03	1.e7e0e80 02	9.e9e4e90-02	1.e5986e0-01	1.e302210 00	9.e652e60-02	3.e996e50 03	1.e498030 05
4.e040000 00	1.e026e6D 03	1.e7e1710 02	1.e023e20-01	1.e595A60-01	1.e300480 00	9.e598e10-02	3.e996e40 03	1.e498e90 05
4.e140000 00	1.e028120 03	1.e7e2e50 02	1.e05e120-01	1.e592270-01	1.e29e780-01	9.e546e10-02	3.e996e40 03	1.e499020 05
4.e240000 00	1.e029e10 03	1.e7e3100 02	1.e0885d0-01	1.e58e120-01	1.e99519e-01	9.e486d20-02	3.e996e30 03	1.e499e20 05
4.e340000 00	1.e031e60 03	1.e7e3e60 02	1.e12067D-01	1.e582220-01	1.e930960-01	9.e426e50-02	3.e996e30 03	1.e499e30 05
4.e440000 00	1.e033e50 03	1.e7e6130 02	1.e152390-01	1.e578170-01	1.e905780-01	9.e3e5950-02	3.e996e30 03	1.e499700 05
4.e540000 00	1.e036200 03	1.e7e9e50 02	1.e193e60-01	1.e573e40-01	1.e87e010-01	9.e33e430-02	3.e996e20 03	1.e5e0050 05
4.e640000 00	1.e037160 03	1.e884e80 02	1.e214e00-01	1.e569610-01	1.e852e30-01	9.e2e1e70-02	3.e996e20 03	1.e500370 05
4.e740000 00	1.e039060 03	1.e8e8130 02	1.e24e410-01	1.e56813J-01	1.e82e450-01	9.e1e4530-02	3.e996e20 03	1.e500660 05
4.e840000 00	1.e041030 03	1.e8e6310 02	1.e27e470-01	1.e564e50-01	1.e79e600-01	9.e19e950-02	3.e996e10 03	1.e500e40 05
4.e940000 00	1.e043e70 03	1.e8e8e43 02	1.e303750-01	1.e55e65J-01	1.e76d770-01	9.e38782-02	3.e996e10 03	1.e501180 05
5.e040000 00	1.e046150 03	1.e8e5e60 02	1.e332290-01	1.e550710-01	1.e735330-01	9.e36737-02	3.e996e10 03	1.e501410 05
5.e140000 00	1.e047280 03	1.e8e8e60 02	1.e360160-01	1.e54be20-01	1.e703e90-01	9.e96837D-02	3.e996e00 03	1.e501610 05
5.e240000 00	1.e049480 03	1.e8e8360 02	1.e387320-01	1.e540e00-01	1.e67d860-01	8.e68672D-02	3.e996e00 03	1.e501800 05
5.e340000 00	1.e051e70 03	1.e8e3230 02	1.e413750-01	1.e53e030-01	1.e63e740-01	8.e64732-02	3.e996e00 03	1.e501980 05
5.e440000 00	1.e053e20 03	1.e8e5e40 02	1.e439150-01	1.e529e20-01	1.e60e320-01	8.e756e30-02	3.e996f90 03	1.e502110 05
5.e540000 00	1.e056210 03	1.e8e6e00 02	1.e44e630-01	1.e523e80-01	1.e57e230-01	8.e681e40-02	3.e996f90 03	1.e502230 05
5.e640000 00	1.e058e40 03	1.e8e6e10 02	1.e468210-01	1.e518e00-01	1.e54e110-01	8.e607310-02	3.e996f80 03	1.e502340 05
5.e740000 00	1.e06e910 03	1.e8e6e60 02	1.e488210-01	1.e513e20-01	1.e52e430-01	8.e532e70-02	3.e996f80 03	1.e502440 05
5.e840000 00	1.e063710 03	1.e8e3810 02	1.e507e60-01	1.e508e30-01	1.e49e960-01	8.e460d20-02	3.e996f70 03	1.e502520 05
5.e940000 00	1.e066750 03	1.e8e3e03 02	1.e5547b0-01	1.e499e80-01	1.e47e200-01	8.e389820-02	3.e996f70 03	1.e502580 05
6.e040000 00	1.e068220 03	1.e8e8950 02	1.e575c40-01	1.e493e40-01	1.e47e900-01	8.e27490-02	3.e996f70 03	1.e502640 05
6.e140000 00	1.e070710 03	1.e8e2e40 02	1.e593320-01	1.e487e00-01	1.e459810-01	8.e192750-02	3.e996f60 03	1.e502680 05
6.e240000 00	1.e073e40 03	1.e8e194D 02	1.e612570-01	1.e480e30-01	1.e43e960-01	8.e112750-02	3.e996f60 03	1.e502710 05
6.e340000 00	1.e075790 03	1.e8e1e60 02	1.e629.e0-01	1.e473630-01	1.e42e310-01	7.e998300-02	3.e996f50 03	1.e502740 05
6.e440000 00	1.e078370 03	1.e8e9823 02	1.e645e70-01	1.e467150-01	1.e41e950-01	7.e917430-02	3.e996f50 03	1.e502760 05
6.e540000 00	1.e080e70 03	1.e8e0e60 02	1.e660e80-01	1.e460e40-01	1.e41e690-01	7.e842e00-02	3.e996f50 03	1.e502780 05
6.e640000 00	1.e083e60 03	1.e8e9790 02	1.e67e7b0-01	1.e453210-01	1.e412e40-01	7.e762900-02	3.e996f40 03	1.e502740 05

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PITCH-ANGLE GAIN = 1.000000000000D 00
PITCH-ANGLE BIAS = 4.039267403390-17 RADIAN

MODEL SOLUTIONS

MODEL 12	P0 = 2.8657797473b218800 04	C00 =	3.49e723499e4015200-02
	P1 = 0.0	C01 =	0.0
MCINT	P2 = 1.12891120J32273000 03	C02 =	1.3111775b0893050000 00
FAILURES	P3 = -2.1853623736076160D 00	C03 =	0.0
0	P4 = 0.0	C04 =	1.9e743b7132e758600 03

FIT ERROR= 0.362189797J2e094UD-09

MODEL 12 FOUND TO BE BEST FIT

LIFT COEFFICIENTS: BY LEAST SQUARE DISTANCE

CLA0= 0.3390e83b7918825b0-02
CLA = 0.e87827f3396701100 01
CLA2= 0.6363b4323639b5J2D 00
ERR= 0.20878e0015866e990D 01
CL0= 0.0

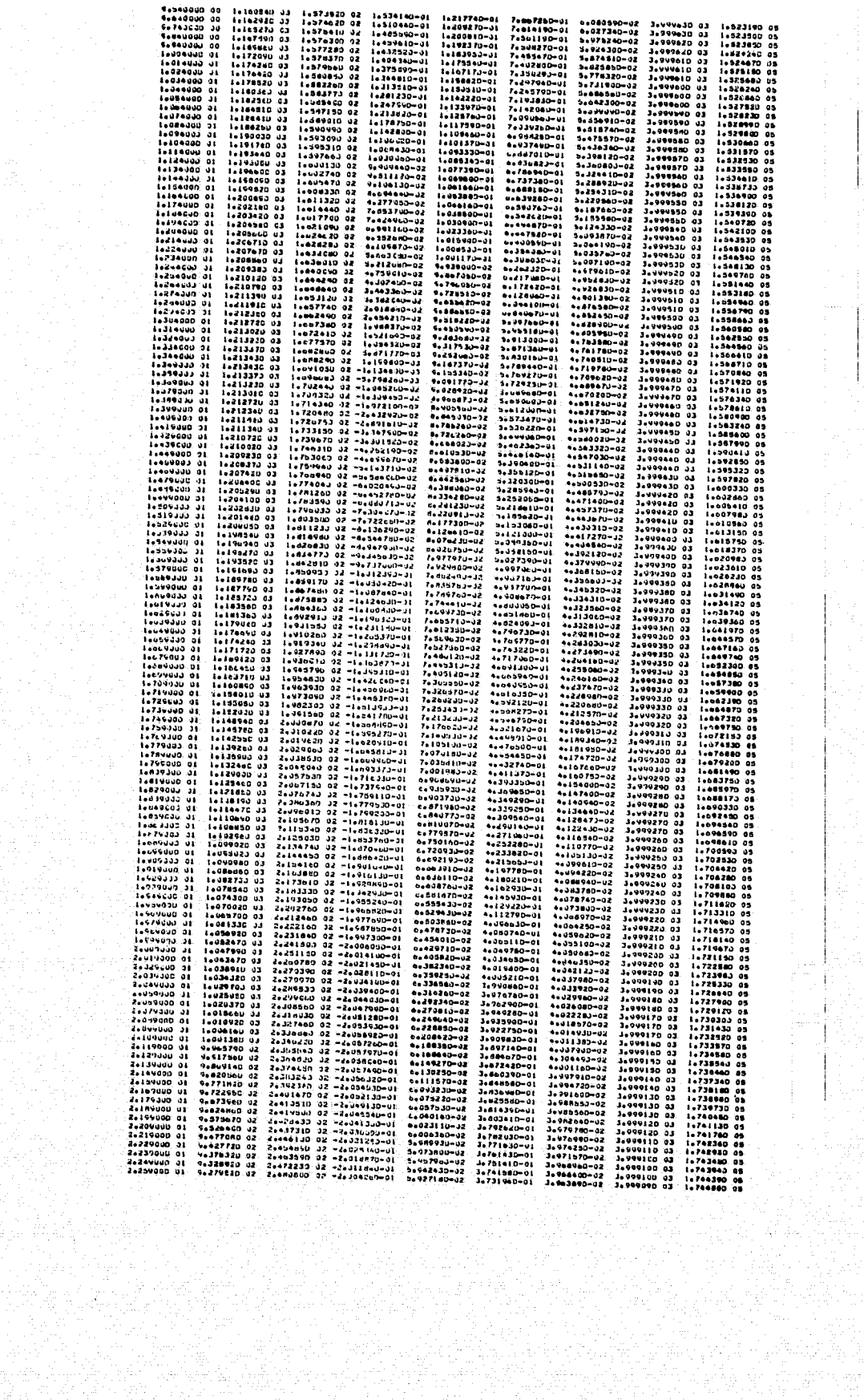
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ESTIMATED SPECIFIC FUEL CONSUMPTION = 2.5270903396438D-07 LBF/(FT-LBF/SEC)/SEC

PATH PERFORMANCE ANALYSIS (ITERATION NO. 6
(ALTITUDE AND AIRSPEED ASSUMED CORRECT)

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.600000D 03	1.467300 02	5.442630-05	1.603038D-01	1.026390 00	1.067580-01	4.000000D 03	1.473680 05
1.000000D-02	1.600000 03	1.467580 02	1.128330-04	1.603040D-01	1.026430 00	1.067640-01	4.000000 03	1.473910 05
2.000000D-02	1.600000 03	1.468320 02	1.756760-04	1.603082D-01	1.026480 00	1.067760-01	4.000000 03	1.474140 05
3.000000D-02	1.600000 03	1.469750 02	2.389510-04	1.603058D-01	1.026520 00	1.067880-01	4.000000 03	1.474370 05
4.000000D-02	1.600000 03	1.469250 02	3.026560-04	1.603068D-01	1.026580 00	1.068000-01	4.000000 03	1.474600 05
4.000000D-02	1.600000 03	1.470180 02	3.667130-04	1.603078D-01	1.026640 00	1.068120-01	4.000000 03	1.474830 05
5.000000D-02	1.600000 03	1.471100 02	4.311400-04	1.603098D-01	1.026720 00	1.068240-01	4.000000 03	1.475060 05
6.000000D-02	1.600000 03	1.472020 02	4.959480-04	1.603105D-01	1.026810 00	1.068360-01	4.000000 03	1.475290 05
6.000000D-01	1.600010 03	1.472940 02	5.611460-04	1.603117D-01	1.026890 00	1.068480-01	3.999980 03	1.475520 05
7.000000D-01	1.600010 03	1.473860 02	6.267440-04	1.603130D-01	1.026980 00	1.068610-01	3.999980 03	1.475750 05
8.000000D-01	1.600020 03	1.474780 02	6.927510-04	1.603150D-01	1.027080 00	1.068730-01	3.999960 03	1.475980 05
9.000000D-01	1.600030 03	1.475710 02	7.591790-04	1.603170D-01	1.027180 00	1.068850-01	3.999940 03	1.476210 05
1.000000D 00	1.600040 03	1.476630 02	8.260410-04	1.603190D-01	1.027290 00	1.068970-01	3.999920 03	1.476440 05
1.100000D 00	1.600050 03	1.477550 02	8.933510-04	1.603210D-01	1.027400 00	1.069100-01	3.999900 03	1.476670 05
1.200000D 00	1.600070 03	1.478480 02	9.611230-04	1.603240D-01	1.027520 00	1.069220-01	3.999870 03	1.476900 05
1.300000D 00	1.600090 03	1.479410 02	1.029370-03	1.603270D-01	1.027650 00	1.069340-01	3.999840 03	1.477130 05
1.400000D 00	1.600110 03	1.480340 02	1.098180-03	1.603300D-01	1.027790 00	1.069460-01	3.999810 03	1.477360 05
1.500000D 00	1.600130 03	1.481270 02	1.167570-03	1.603330D-01	1.027930 00	1.069590-01	3.999780 03	1.477590 05
1.600000D 00	1.600160 03	1.482200 02	1.237560-03	1.603370D-01	1.028080 00	1.069710-01	3.999740 03	1.477820 05
1.700000D 00	1.600190 03	1.483130 02	1.308170-03	1.603410D-01	1.028240 00	1.069830-01	3.999700 03	1.478050 05
1.800000D 00	1.600220 03	1.484060 02	1.379420-03	1.603450D-01	1.028400 00	1.069950-01	3.999660 03	1.478280 05
1.900000D 00	1.600250 03	1.484990 02	1.451330-03	1.603500D-01	1.028580 00	1.070080-01	3.999610 03	1.478510 05
2.000000D 00	1.600290 03	1.485920 02	1.523920-03	1.603550D-01	1.028760 00	1.070200-01	3.999560 03	1.478740 05
2.100000D 00	1.600330 03	1.486850 02	1.597210-03	1.603600D-01	1.028950 00	1.070320-01	3.999510 03	1.478970 05
2.200000D 00	1.600370 03	1.487780 02	1.671220-03	1.603660D-01	1.029150 00	1.070440-01	3.999460 03	1.479200 05
2.300000D 00	1.600420 03	1.488710 02	1.745970-03	1.603720D-01	1.029360 00	1.070560-01	3.999400 03	1.479430 05
2.400000D 00	1.600470 03	1.489640 02	1.821480-03	1.603790D-01	1.029580 00	1.070680-01	3.999340 03	1.479660 05
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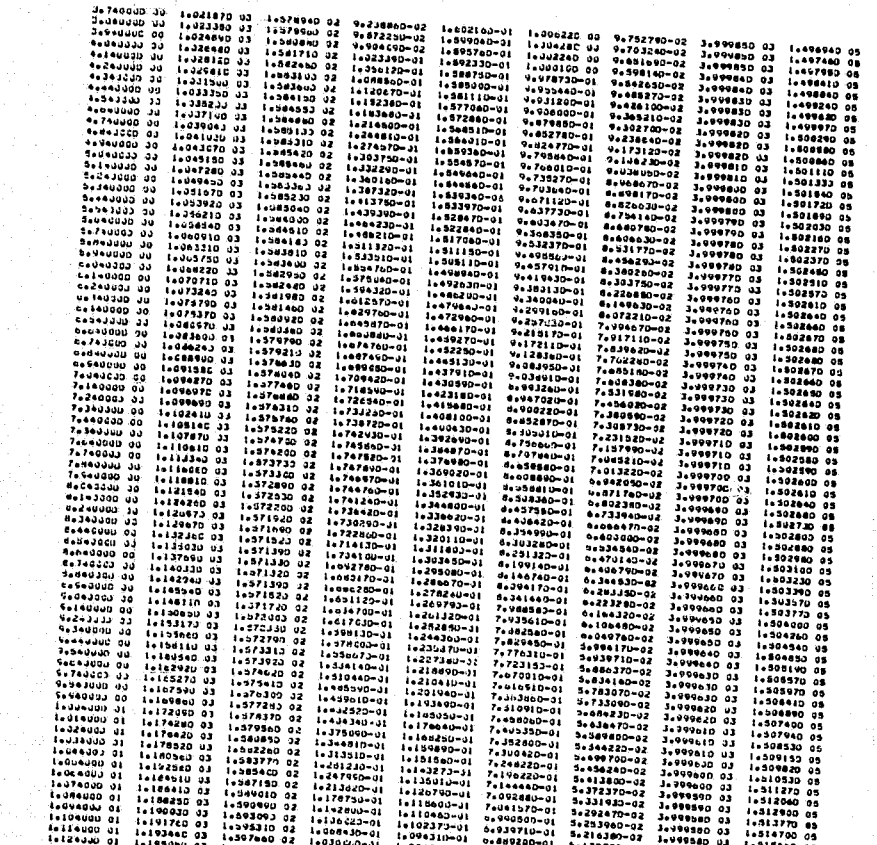
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2.409000 01	8.417890 02	2.320780 02	-1.832140-01	9.731130-02	3.607880-01	3.932350-02	3.998020 03	1.747300 05
2.419000 01	8.359671 02	2.308145 02	-1.813723-01	9.720070-02	3.600890-01	3.930602-02	3.998020 03	1.747190 05
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2.439000 01	8.243940 02	2.282620 02	-1.781490-01	9.698660-02	3.587330-01	3.927280-02	3.998010 03	1.747080 05
2.449000 01	8.186460 02	2.269720 02	-1.769730-01	9.688280-02	3.580760-01	3.925680-02	3.998010 03	1.746980 05
2.459000 01	8.129250 02	2.256730 02	-1.747540-01	9.678130-02	3.574340-01	3.924080-02	3.998000 03	1.746750 05
2.469000 01	8.072180 02	2.243670 02	-1.729960-01	9.668200-02	3.568060-01	3.922510-02	3.998000 03	1.746580 05
2.479000 01	8.015330 02	2.230510 02	-1.712000-01	9.658500-02	3.561920-01	3.921000-02	3.998000 03	1.746420 05
2.489000 01	7.958780 02	2.217260 02	-1.694960-01	9.649010-02	3.555910-01	3.919530-02	3.998000 03	1.746220 05
2.499000 01	7.902510 02	2.203910 02	-1.674590-01	9.639730-02	3.550040-01	3.918090-02	3.998000 03	1.746010 05
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2.599000 01	7.356510 02	2.065220 02	-1.467990-01	9.558130-02	3.498370-01	3.905580-02	3.998000 03	1.743140 05
2.609000 01	7.303610 02	2.050810 02	-1.444410-01	9.551090-02	3.493870-01	3.904500-02	3.998000 03	1.742790 05
2.619000 01	7.251030 02	2.036300 02	-1.421500-01	9.544270-02	3.489490-01	3.903450-02	3.998000 03	1.742440 05
2.629000 01	7.198760 02	2.021690 02	-1.398260-01	9.537330-02	3.485220-01	3.902430-02	3.998000 03	1.742080 05
2.639000 01	7.146800 02	2.006980 02	-1.374680-01	9.530780-02	3.481080-01	3.901430-02	3.998000 03	1.741720 05
2.649000 01	7.095150 02	1.992170 02	-1.350820-01	9.524370-02	3.477020-01	3.900470-02	3.998000 03	1.741350 05
2.659000 01	7.043820 02	1.977260 02	-1.326680-01	9.518150-02	3.473080-01	3.899530-02	3.998000 03	1.740980 05
2.669000 01	6.992810 02	1.962250 02	-1.302260-01	9.512100-02	3.469250-01	3.898620-02	3.998000 03	1.740610 05
2.679000 01	6.942110 02	1.947140 02	-1.277560-01	9.506220-02	3.465530-01	3.897740-02	3.998000 03	1.740230 05
2.689000 01	6.891740 02	1.931930 02	-1.252590-01	9.500510-02	3.461910-01	3.896883-02	3.998000 03	1.739850 05
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2.729000 01	6.693510 02	1.870090 02	-1.150130-01	9.479300-02	3.448480-01	3.893700-02	3.998000 03	1.738320 05
2.739000 01	6.644760 02	1.854390 02	-1.123900-01	9.474390-02	3.445360-01	3.892980-02	3.998000 03	1.737940 05
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2.769000 01	6.500440 02	1.806680 02	-1.043850-01	9.460580-02	3.436660-01	3.890910-02	3.998000 03	1.736820 05
2.779000 01	6.452960 02	1.790530 02	-1.016730-01	9.456260-02	3.433910-01	3.890270-02	3.998000 03	1.736450 05
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2.799000 01	6.358980 02	1.757940 02	-9.618970-02	9.448110-02	3.428680-01	3.889050-02	3.998000 03	1.735720 05
2.809000 01	6.312460 02	1.741490 02	-9.341380-02	9.444240-02	3.426200-01	3.888460-02	3.998000 03	1.735370 05
2.819000 01	6.266270 02	1.724940 02	-9.062190-02	9.440510-02	3.423930-01	3.887920-02	3.998000 03	1.735020 05
2.829000 01	6.220390 02	1.708270 02	-8.781130-02	9.436910-02	3.421650-01	3.887390-02	3.998000 03	1.734670 05
2.839000 01	6.174830 02	1.691510 02	-8.498320-02	9.433460-02	3.419460-01	3.886880-02	3.998000 03	1.734340 05
2.849000 01	6.129580 02	1.674630 02	-8.213770-02	9.430130-02	3.417360-01	3.886390-02	3.998000 03	1.734010 05

PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

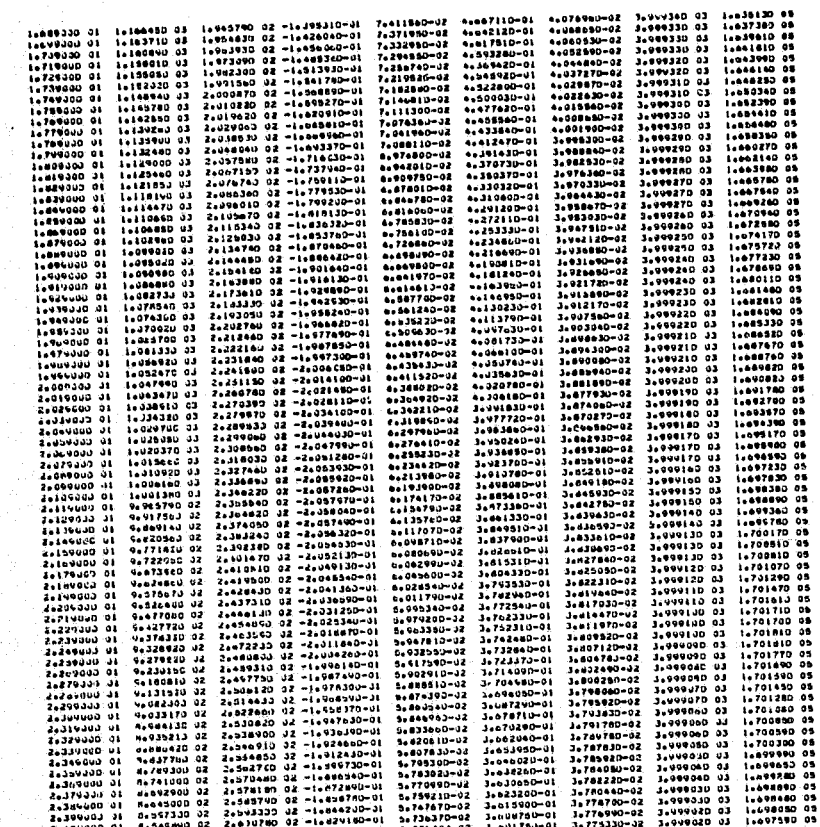
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CDI :	0.0	+	0.0	=	0.0
CDS :	0.1381177868305090 01	+	-0.6047639243386d360-01	=	0.1250703116e968910 01
CD3 :	0.0	+	0.0	=	0.0
CD4 :	0.1967438713287d460 06	+	-0.8815342285987d3D0 02	=	0.1868286329861171D 06
CLA0:	-0.3590e63679188825e0-02	+	-0.1375864255742494D-03	=	-0.3526252114762250D-02
CLA :	0.8376227433907d7D110 01	+	-0.1362364298607753D-02	=	0.8375e8590e9e686020 01
CLAM:	-0.8363543283959e320 30	+	-0.111d9313016990d67D-01	=	-0.8469747e3856546383 30

PATH PERFORMANCE SUBITERATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.300000 03	1.4e7390 02	5.1424D0-05	1.832610-01	1.025030 00	1.025320-01	4.000000 03	1.449550 05
1.000000-02	1.000000 03	1.4e7860 02	1.12E3D0-04	1.832670-01	1.025030 00	1.025440-01	4.000000 03	1.449750 05
2.000000-02	1.000000 03	1.4e8320 02	1.756760-04	1.832540-01	1.025120 00	1.025560-01	4.000000 03	1.449963 05
3.300330-02	1.000000 03	1.408750 02	2.399510-04	1.832610-01	1.025160 00	1.025670-01	4.000000 03	1.450160 05
4.000000-02	1.000000 03	1.409250 02	3.0565E0-04	1.832680-01	1.025200 00	1.025790-01	4.000000 03	1.450360 05
5.000000-02	1.000000 03	1.473180 02	4.413440-04	1.832810-01	1.025260 00	1.026020-01	4.000000 03	1.450770 05
6.000000-02	1.000000 03	1.471100 02	5.827180-04	1.832950-01	1.025370 00	1.026250-01	4.000000 03	1.451170 05
1.000000-01	1.000010 03	1.472020 02	7.297590-04	1.833080-01	1.025480 00	1.026467-01	4.000000 03	1.451573 05
1.200200-01	1.000010 03	1.472940 02	8.824440-04	1.833210-01	1.025630 00	1.026700-01	3.999990 03	1.451970 05
1.400000-01	1.000010 03	1.473860 02	1.040750-03	1.833330-01	1.025610 00	1.026920-01	3.999990 03	1.452360 05
1.600000-01	1.000020 03	1.475690 02	1.374160-03	1.833580-01	1.025760 00	1.027330-01	3.999980 03	1.453150 05
1.800000-01	1.000020 03	1.477510 02	1.729710-03	1.833830-01	1.025910 00	1.027740-01	3.999980 03	1.453940 05
2.e30000-01	1.000040 03	1.479310 02	2.107670-03	1.834060-01	1.026060 00	1.028170-01	3.999990 03	1.454720 05
3.000000-01	1.000050 03	1.481110 02	2.507C10-03	1.834290-01	1.026200 00	1.028580-01	3.999990 03	1.455490 05
3.400000-01	1.000070 03	1.482890 02	2.928250-03	1.834510-01	1.026360 00	1.028950-01	3.999990 03	1.456260 05
4.230000-01	1.000110 03	1.486620 02	3.e35D2D-03	1.834930-01	1.026620 00	1.029670-01	3.999980 03	1.457770 05
5.000000-01	1.000160 03	1.489910 02	4.426160-03	1.835310-01	1.026860 00	1.030330-01	3.999980 03	1.459260 05
5.800000-01	1.000220 03	1.493350 02	5.000170-03	1.835860-01	1.027060 00	1.030940-01	3.999980 03	1.460720 05
6.e03000-01	1.000300 03	1.496740 02	7.e05530-03	1.835980-01	1.027260 00	1.031490-01	3.999970 03	1.462160 05
7.400000-01	1.000390 03	1.500070 02	8.289960-03	1.836260-01	1.027430 00	1.031970-01	3.999970 03	1.463570 05
8.000000-01	1.000530 03	1.504170 02	9.942410-03	1.836950-01	1.027610 00	1.032480-01	3.999960 03	1.465290 05
9.400000-01	1.000680 03	1.508180 02	1.171280-02	1.836780-01	1.027750 00	1.032870-01	3.999960 03	1.466970 05
1.060000 00	1.000880 03	1.512090 02	1.359760-02	1.836940-01	1.027850 00	1.033150-01	3.999960 03	1.468610 05
1.180000 00	1.001100 03	1.515920 02	1.555J2D-02	1.837030-01	1.027910 00	1.033310-01	3.999950 03	1.470200 05
1.240000 00	1.001360 03	1.519650 02	1.769560-02	1.837050-01	1.027920 00	1.033340-01	3.999950 03	1.471760 05
1.340000 00	1.001640 03	1.523290 02	1.990120-02	1.836990-01	1.027860 00	1.033240-01	3.999950 03	1.473270 05
1.440000 00	1.001960 03	1.526810 02	2.220560-02	1.836860-01	1.027710 00	1.032980-01	3.999940 03	1.474734 05
1.540000 00	1.002320 03	1.530260 02	2.460560-02	1.836610-01	1.027640 00	1.032580-01	3.999940 03	1.476150 05
1.640000 00	1.002720 03	1.533610 02	2.709620-02	1.836260-01	1.027440 00	1.032010-01	3.999930 03	1.477520 05
1.740100 00	1.003180 03	1.536830 02	2.967360-02	1.835880-01	1.027180 00	1.031280-01	3.999930 03	1.478860 05
1.840100 00	1.003690 03	1.539960 02	3.233280-02	1.835360-01	1.026890 00	1.030370-01	3.999930 03	1.480150 05
1.940000 00	1.004180 03	1.542980 02	3.507C2D-02	1.834700-01	1.026460 00	1.029280-01	3.999920 03	1.481390 05
2.040000 00	1.004710 03	1.545890 02	3.788C90-02	1.833960-01	1.026000 00	1.028000-01	3.999920 03	1.482580 05
2.140000 00	1.005320 03	1.548690 02	4.076C40-02	1.833110-01	1.025470 00	1.026520-01	3.999920 03	1.483750 05
2.240000 00	1.005970 03	1.551390 02	4.370410-02	1.832130-01	1.024860 00	1.024880-01	3.999910 03	1.484870 05
2.340000 00	1.006680 03	1.553990 02	4.670750-02	1.831040-01	1.024180 00	1.023090-01	3.999910 03	1.485930 05
2.440000 00	1.007430 03	1.556460 02	4.976590-02	1.829830-01	1.023430 00	1.021020-01	3.999900 03	1.486980 05
2.540000 00	1.008230 03	1.558830 02	5.287460-02	1.828500-01	1.022600 00	1.018660-01	3.999900 03	1.487980 05
2.640000 00	1.009070 03	1.561090 02	5.602880-02	1.827040-01	1.021700 00	1.016170-01	3.999900 03	1.488930 05
2.740000 00	1.009970 03	1.563240 02	5.922450-02	1.825460-01	1.020710 00	1.013490-01	3.999890 03	1.489850 05
2.840100 00	1.010920 03	1.565270 02	6.245550-02	1.823740-01	1.019650 00	1.010600-01	3.999890 03	1.490720 05
2.940000 00	1.011930 03	1.567220 02	6.571840-02	1.821900-01	1.018500 00	1.007510-01	3.999880 03	1.491560 05
3.040000 00	1.012980 03	1.569050 02	6.900810-02	1.819920-01	1.017270 00	1.004210-01	3.999880 03	1.492350 05
3.140000 00	1.014090 03	1.570770 02	7.231980-02	1.817810-01	1.015960 00	1.000700-01	3.999880 03	1.493120 05
3.240000 00	1.015250 03	1.572390 02	7.564880-02	1.815560-01	1.014550 00	9.969810-02	3.999870 03	1.493860 05
3.340000 00	1.016470 03	1.573900 02	7.899C50-02	1.813170-01	1.013070 00	9.930540-02	3.999870 03	1.494530 05
3.440000 00	1.017740 03	1.575310 02	8.234C00-02	1.810630-01	1.011490 00	9.889190-02	3.999870 03	1.495180 05
3.540000 00	1.019060 03	1.576620 02	8.569260-02	1.807950-01	1.009820 00	9.845780-02	3.999860 03	1.495800 05
3.640000 00	1.020440 03	1.577830 02	8.904370-02	1.805130-01	1.008070 00	9.800310-02	3.999860 03	1.496390 05



ORIGINAL PAGE IS
OF POOR QUALITY



PITCH-ANGLE GAIN = 1.000000000000D 00
PITCH-ANGLE BIAS = 3.108850848430E-17 RADIAN

MODEL SOLUTIONS

MODEL 12   P0 = 2.465718204693680D 04   CD0 = 3.495983070157546D-02
P1 = 0.0   CD1 = 0.0
POINT   P2 = 1.128753906188838D 03   CD2 = 1.310610748886093D 00
FAILURES   P3 = -2.180026386401133D 00   CD3 = 0.0
= 0   P4 = 0.0   CD4 = 1.978755481670838D 03

FIT ERROR= 4.753518219399436D-09

MODEL 12 FOUND TO BE BEST FIT

LIFT COEFFICIENTS BY LEAST SQUARE DISTANCE

CLA0=-0.3202348282264754D-02
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CLAX=-0.6019870278871460D 00
EXPK= 0.2089180816918498D 01
CLO= 0.0

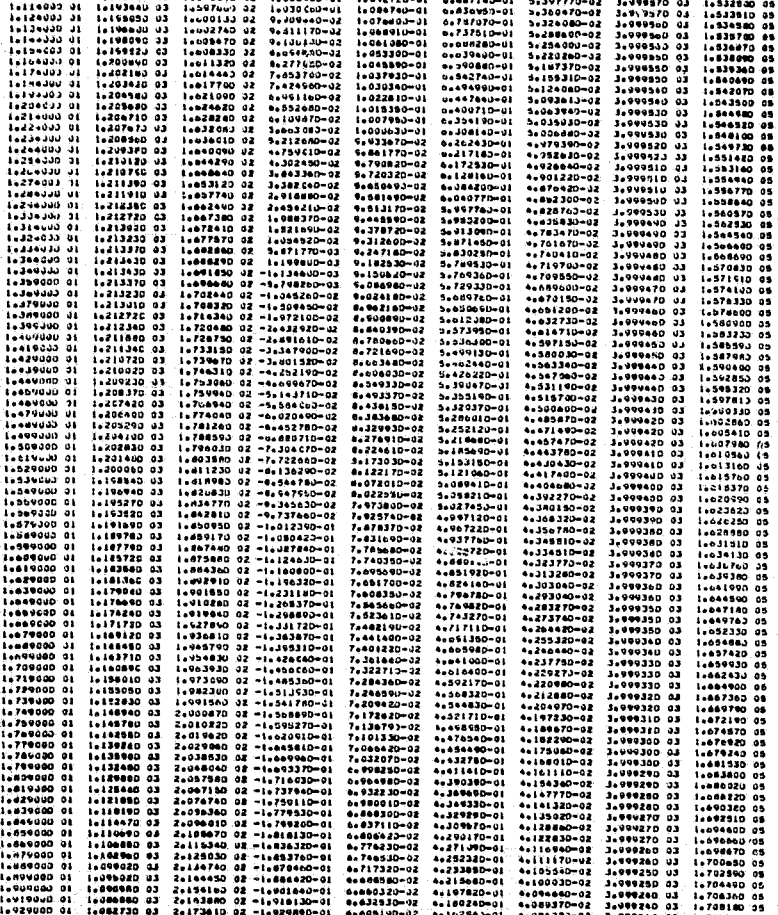
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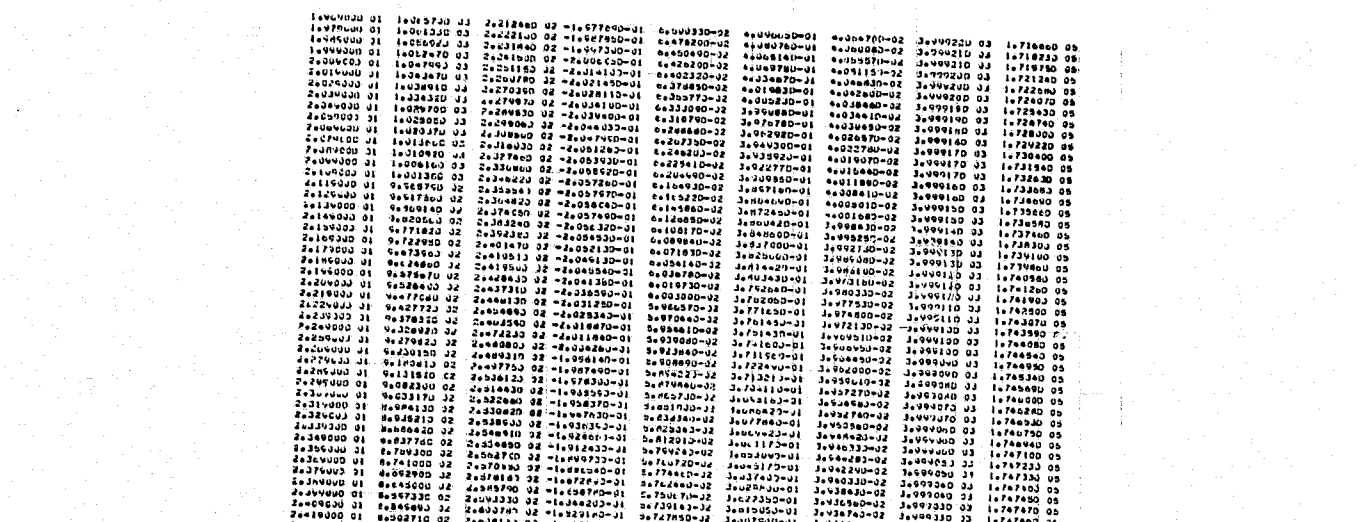
PATH PERFORMANCE ANALYSIS ITERATION NO. 5
(ALTITUDE AND AIRSPEED ASSUMED CORRECT)

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.000000D 03	1.467390D 02	5.142630D-05	1.629210D-01	1.024620D 00	1.067520D-01	4.000000D 03	1.473860D 05
1.000000D-02	1.000000D 03	1.467860D 02	1.128330D-04	1.629280D-01	1.024660D 00	1.067640D-01	4.000000D 03	1.473890D 05
2.000000D-02	1.000000D 03	1.468320D 02	1.750760D-04	1.629350D-01	1.024510D 00	1.067760D-01	4.000000D 03	1.474110D 05
3.000000D-02	1.000000D 03	1.468790D 02	2.399510D-04	1.629410D-01	1.024550D 00	1.067890D-01	4.000000D 03	1.474340D 05
4.000000D-02	1.000000D 03	1.469250D 02	3.056560D-04	1.629480D-01	1.024590D 00	1.068010D-01	4.000000D 03	1.474570D 05
6.000000D-02	1.000000D 03	1.470180D 02	4.413440D-04	1.629610D-01	1.024670D 00	1.068240D-01	4.000000D 03	1.475020D 05
8.013300D-02	1.000000D 03	1.471100D 02	5.827180D-04	1.629750D-01	1.024760D 00	1.068480D-01	4.000000D 03	1.475480D 05
1.020000D-01	1.000010D 03	1.472020D 02	7.297590D-04	1.629880D-01	1.024840D 00	1.068710D-01	4.000000D 03	1.475930D 05
1.200000D-01	1.000010D 03	1.472940D 02	8.824440D-04	1.630000D-01	1.024920D 00	1.068940D-01	3.999990D 03	1.476380D 05
1.400000D-01	1.000010D 03	1.473860D 02	1.040750D-03	1.630130D-01	1.025000D 00	1.069170D-01	3.999990D 03	1.476830D 05
1.800000D-01	1.000020D 03	1.475690D 02	1.374160D-03	1.630380D-01	1.025150D 00	1.069620D-01	3.999990D 03	1.477720D 05
2.230000D-01	1.000030D 03	1.477510D 02	1.729790D-03	1.630620D-01	1.025300D 00	1.070050D-01	3.999990D 03	1.478600D 05
2.600000D-01	1.000040D 03	1.479310D 02	2.107470D-03	1.630850D-01	1.025450D 00	1.070470D-01	3.999990D 03	1.479460D 05
3.033300D-01	1.000050D 03	1.481110D 02	2.507010D-03	1.631080D-01	1.025590D 00	1.070880D-01	3.999990D 03	1.480350D 05
3.400000D-01	1.000070D 03	1.482890D 02	2.928250D-03	1.631300D-01	1.025730D 00	1.071280D-01	3.999990D 03	1.481220D 05
4.200000D-01	1.000110D 03	1.486420D 02	3.835020D-03	1.631720D-01	1.025980D 00	1.072020D-01	3.999980D 03	1.482920D 05
5.000000D-01	1.000160D 03	1.489910D 02	4.826150D-03	1.632100D-01	1.026220D 00	1.072710D-01	3.999980D 03	1.484600D 05
5.833000D-01	1.000220D 03	1.493350D 02	5.900170D-03	1.632450D-01	1.026440D 00	1.073340D-01	3.999970D 03	1.486260D 05
6.633000D-01	1.000300D 03	1.496740D 02	7.055320D-03	1.632760D-01	1.026630D 00	1.073910D-01	3.999970D 03	1.487880D 05
7.400000D-01	1.000390D 03	1.500070D 02	8.289900D-03	1.633040D-01	1.026810D 00	1.074410D-01	3.999970D 03	1.489470D 05
8.400000D-01	1.000530D 03	1.504170D 02	9.942410D-03	1.633330D-01	1.026990D 00	1.074930D-01	3.999960D 03	1.491420D 05
9.400000D-01	1.000690D 03	1.508130D 02	1.171280D-02	1.633560D-01	1.027130D 00	1.075340D-01	3.999960D 03	1.493320D 05
1.040000D 00	1.000880D 03	1.512090D 02	1.359760D-02	1.633720D-01	1.027230D 00	1.075630D-01	3.999960D 03	1.495170D 05
1.140000D 00	1.001100D 03	1.515920D 02	1.559320D-02	1.633830D-01	1.027280D 00	1.075790D-01	3.999950D 03	1.496970D 05
1.240000D 00	1.001360D 03	1.519650D 02	1.769560D-02	1.633820D-01	1.027300D 00	1.075820D-01	3.999950D 03	1.498720D 05
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1.740000D 00	1.003150D 03	1.536830D 02	2.967340D-02	1.632630D-01	1.026550D 00	1.073670D-01	3.999930D 03	1.506690D 05
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1.940000D 00	1.004150D 03	1.542980D 02	3.507020D-02	1.631460D-01	1.025840D 00	1.071600D-01	3.999920D 03	1.509510D 05
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2.140000D 00	1.005320D 03	1.548690D 02	4.076040D-02	1.629890D-01	1.024850D 00	1.068740D-01	3.999920D 03	1.512110D 05
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2.340000D 00	1.006680D 03	1.553980D 02	4.670750D-02	1.627840D-01	[illegible]	1.065070D-01	3.999910D 03	1.514510D 05
2.440000D 00	1.007430D 03	1.556460D 02	4.976590D-02	1.626630D-01	[illegible]	1.062920D-01	3.999900D 03	1.515620D 05
2.540000D 00	1.008230D 03	1.558830D 02	5.287450D-02	1.625300D-01	[illegible]	1.060560D-01	3.999900D 03	1.516690D 05
2.640000D 00	1.009070D 03	1.561090D 02	5.602980D-02	1.623850D-01	[illegible]	1.057990D-01	3.999900D 03	1.517700D 05
2.740000D 00	1.009970D 03	1.563240D 02	5.922400D-02	1.622270D-01	1.020100D 00	1.055210D-01	3.999890D 03	1.518660D 05
2.840000D 00	1.010920D 03	1.565290D 02	6.245550D-02	1.620570D-01	1.019040D 00	1.052220D-01	3.999890D 03	1.519570D 05
2.940000D 00	1.011930D 03	1.567220D 02	6.571640D-02	1.618730D-01	1.017490D 00	1.049010D-01	3.999880D 03	1.520430D 05
3.040000D 00	1.012960D 03	1.569050D 02	6.900810D-02	1.616760D-01	1.016060D 00	1.045580D-01	3.999880D 03	1.521250D 05
3.140000D 00	1.014090D 03	1.570770D 02	7.231980D-02	1.614650D-01	1.015360D 00	1.041940D-01	3.999880D 03	1.522010D 05
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3.440000D 00	1.017740D 03	1.575310D 02	8.234000D-02	1.607510D-01	1.010900D 00	1.029710D-01	3.999870D 03	1.524000D 05
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3.940000D 00	1.024890D 03	1.580880D 02	9.904090D-02	1.592700D-01	1.001660D 00	1.005060D-01	3.999850D 03	1.526420D 05
4.040000D 00	1.026480D 03	1.581710D 02	1.023390D-01	1.589290D-01	9.995340D-01	9.994980D-02	3.999840D 03	1.526780D 05
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4.240000D 00	1.029810D 03	1.583100D 02	1.088560D-01	1.581990D-01	9.949830D-01	9.877800D-02	3.999830D 03	1.527370D 05
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4.440000D 00	1.033350D 03	1.584150D 02	1.152380D-01	1.574070D-01	9.900480D-01	9.753140D-02	3.999830D 03	1.527810D 05
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5.240000D 00	1.049480D 03	1.585360D 02	1.387320D-01	1.536600D-01	9.666040D-01	9.193770D-02	3.999800D 03	1.528280D 05
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5.440000D 00	1.053920D 03	1.585040D 02	1.439390D-01	1.525680D-01	9.598510D-01	9.042240D-02	3.999790D 03	1.528120D 05
5.540000D 00	1.056210D 03	1.584800D 02	1.464230D-01	1.520060D-01	9.563450D-01	8.965200D-02	3.999780D 03	1.528000D 05
5.640000D 00	1.058840D 03	1.584510D 02	1.488210D-01	1.514310D-01	9.527540D-01	8.887420D-02	3.999780D 03	1.527870D 05
5.740000D 00	1.060910D 03	1.584160D 02	1.511320D-01	1.508420D-01	9.490780D-01	8.808980D-02	3.999780D 03	1.527720D 05
5.840000D 00	1.063310D 03	1.583810D 02	1.533810D-01	1.502400D-01	9.453190D-01	8.729960D-02	3.999770D 03	1.527550D 05
5.940000D 00	1.065750D 03	1.583460D 02	1.554760D-01	1.496250D-01	9.414780D-01	8.650440D-02	3.999770D 03	1.527370D 05
6.040000D 00	1.068220D 03	1.582950D 02	1.575640D-01	1.489970D-01	9.375550D-01	8.570500D-02	3.999760D 03	1.527170D 05
6.140000D 00	1.070710D 03	1.582480D 02	1.594320D-01	1.483560D-01	9.335510D-01	8.490240D-02	3.999760D 03	1.526950D 05
6.240000D 00	1.073240D 03	1.581980D 02	1.612570D-01	1.477020D-01	9.294700D-01	8.409750D-02	3.999760D 03	1.526730D 05
6.340000D 00	1.075790D 03	1.581460D 02	1.629760D-01	1.470370D-01	9.253140D-01	8.329130D-02	3.999750D 03	1.526500D 05
6.440000D 00	1.078370D 03	1.580920D 02	1.645870D-01	1.463600D-01	9.210840D-01	8.248490D-02	3.999750D 03	1.526250D 05

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PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

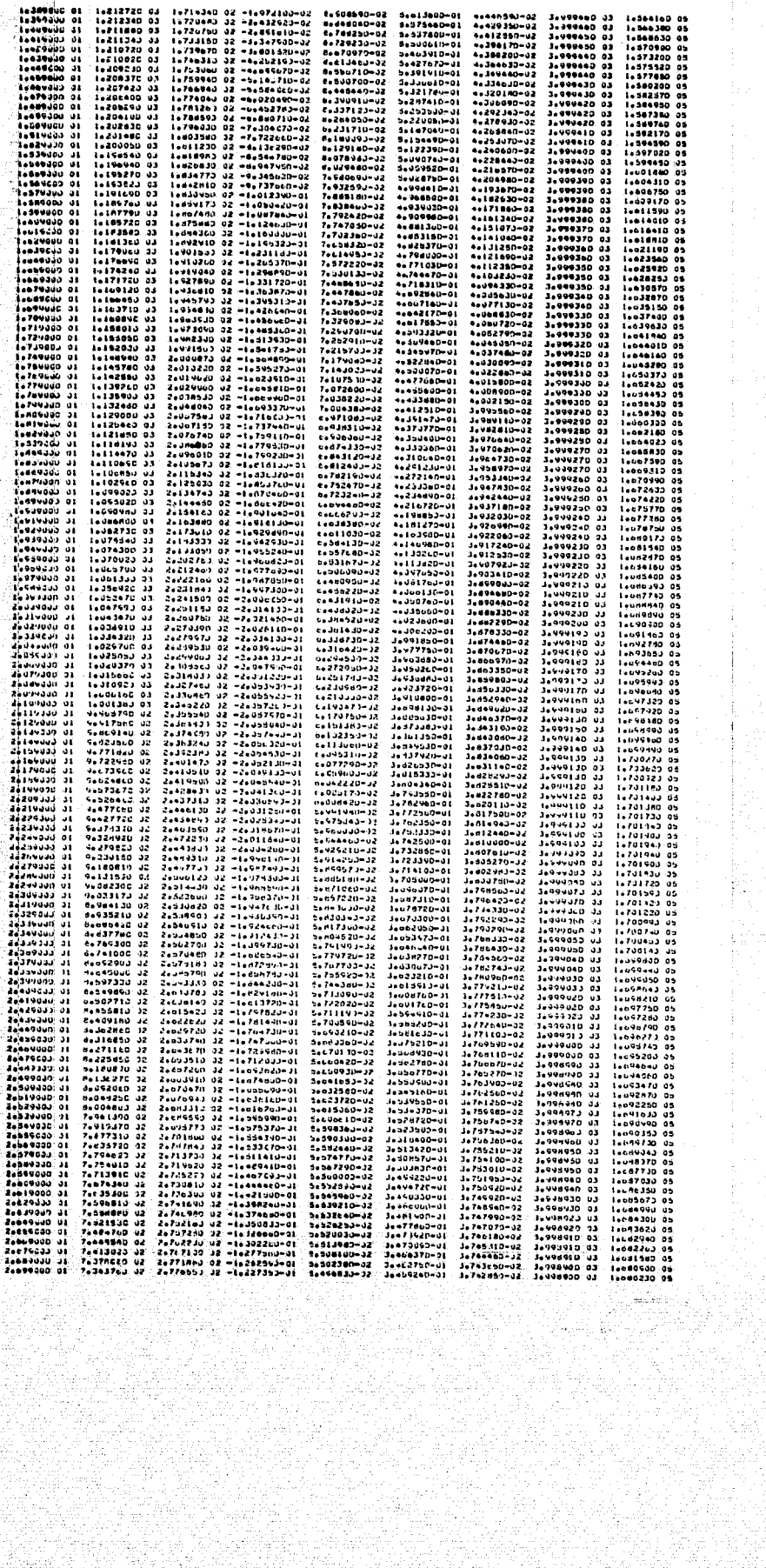
	CLO		DELTA		NEW
CDO :	9.343596830701575460-01	+	+0.13e0422b1473ae00-02	=	0.335994080806467000-01
CDI :	0.0	+	0.0	=	0.0
CD2 :	0.1310961074958e6930 01	+	+0.c0e1318519b778670-01	=	0.e1249997b603895150 01
CD3 :	0.0	+	0.0	=	0.0
CD4 :	0.197875954187C8380 04	+	+0.2e0550b3156302e9950 02	=	0.1892669620131915380 04
CLA0:	-0.382023=82922647560-02	+	-0.137511330227c9540-03	=	-0.333685955882926390-02
CLA 1 :	0.e377363218044997407 01	+	+0.13d8e4928406715040-02	=	0.e375e98a592035233 01
CLA#1 :	-0.501987027887164e43 00	+	-0.1143521413d863d80-01	=	-0.b134222390179903n 00

PATH PERFORMANCE SUBITERATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.0000C0 03	1.4e7390 02	5.e142630-05	1.e031240-01	1.025uc0 00	1.025210-01	4.000000 03	1.449ae0 05
1.e333300-02	1.000C00 03	1.4e7e60 02	1.e126330-04	1.e031300-01	1.02u110 00	1.025330-01	4.000000 03	1.449e60 05
2.e999e0-02	1.000000 03	1.4e8320 02	1.e79e7b0-04	1.e031370-01	1.025150 00	1.025440-01	4.000000 03	1.449e60 05
3.000000-02	1.000000 03	1.4e8793 02	2.e399b10-04	1.e031440-01	1.025150 00	1.025560-01	4.000000 03	1.450070 05
4.e00000-02	1.000000 03	1.4e9250 02	3.e956c0a-04	1.e03151D-01	1.025230 00	1.025680-01	4.000000 03	1.450070 05
5.000000-02	1.000C00 03	1.4e7180 02	4.e613e40-04	1.e03164D-01	1.025320 00	1.025780-01	4.000000 03	1.450070 05
6.000000-02	1.000C00 03	1.4e7100 02	5.e427180-04	1.e03177D-01	1.025420 00	1.025910-01	4.000000 03	1.450070 05
1.e000000-01	1.000001C 03	1.4e7020 02	7.e297590-04	1.e031900-01	1.025e60 00	1.026140-01	4.000000 03	1.450070 05
1.e000000-01	1.000001C 03	1.4e7296d 02	9.e82e44d-04	1.e032030-01	1.025660 00	1.026380-01	4.000000 03	1.451070 05
1.e000000-01	1.000001C 03	1.4e7380 02	1.e0e0750-03	1.e032160-01	1.025980 00	1.026580-01	4.000000 03	1.451470 05
2.e000000-01	1.000002D 03	1.4e7b90 02	1.e374160-03	1.e032610-01	1.025ae8 00	1.026680-01	3.999990 03	1.451870 05
2.e333000-01	1.000003D 03	1.4e7510 02	1.e729790-03	1.e032610-01	1.025400 00	1.027230-01	3.999990 03	1.452370 05
2.e000000-01	1.000004D 03	1.4e7931D 02	2.e187670-03	1.e032650-01	1.025990 00	1.027650-01	3.999990 03	1.453360 05
3.000000-01	1.000005D 03	1.4e81163 02	2.e337013-03	1.e033e30-01	1.025e90 00	1.028e80-01	3.999990 03	1.453e60 05
3.e000000-01	1.000007D 03	1.4e82860 02	2.e726250-03	1.e033360-01	1.026230 00	1.029650-01	3.999990 03	1.454e20 05
4.e000000-01	1.000011D 03	1.4e8e620 02	3.e835CC0-03	1.e033750-01	1.026370 00	1.029830-01	3.999990 03	1.455e00 05
5.000000-01	1.000018D 03	1.4e9091D 02	4.e826168-03	1.e033e30-01	1.026e30 00	1.029550-01	3.999990 03	1.456e60 05
5.e000000-01	1.000029C 03	1.4e93350 02	5.e601170-03	1.e034140-01	1.026870 00	1.030220-01	3.999990 03	1.457670 05
6.e000000-01	1.000300 03	1.4e9e740 02	7.e335323-03	1.e03e480-01	1.027090 00	1.030820-01	3.999980 03	1.459180 05
					1.027e80 00	1.031370-01	3.999970 03	1.4e2060 05

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7.400000D-01	1.000390D 03	1.500070D 02	8.289960D-03	1.635080D-01	1.027460D 00	1.031850D-01	3.999970D 03	1.463470D 05
8.400000D-01	1.000530D 03	1.504170D 02	9.942610D-03	1.635370D-01	1.027660D 00	1.032360D-01	3.999960D 03	1.465190D 05
9.400000D-01	1.000690D 03	1.508180D 02	1.171280D-02	1.635600D-01	1.027740D 00	1.032760D-01	3.999960D 03	1.466870D 05
1.040000D 00	1.000860D 03	1.512090D 02	1.359760D-02	1.635780D-01	1.027880D 00	1.033060D-01	3.999960D 03	1.468510D 05
1.140000D 00	1.001100D 03	1.515920D 02	1.554320D-02	1.635850D-01	1.027940D 00	1.033190D-01	3.999950D 03	1.470100D 05
1.240000D 00	1.001360D 03	1.519650D 02	1.759800D-02	1.635870D-01	1.027950D 00	1.033220D-01	3.999950D 03	1.471650D 05
1.340000D 00	1.001640D 03	1.523270D 02	1.990120D-02	1.635810D-01	1.027910D 00	1.033120D-01	3.999950D 03	1.473160D 05
1.440000D 00	1.001960D 03	1.526830D 02	2.220590D-02	1.635640D-01	1.027820D 00	1.032880D-01	3.999940D 03	1.474620D 05
1.540000D 00	1.002320D 03	1.530260D 02	2.460560D-02	1.635630D-01	1.027670D 00	1.032460D-01	3.999940D 03	1.476040D 05
1.640000D 00	1.002720D 03	1.533600D 02	2.709620D-02	1.635100D-01	1.027470D 00	1.031890D-01	3.999930D 03	1.477420D 05
1.740000D 00	1.003150D 03	1.536830D 02	2.967340D-02	1.634680D-01	1.027210D 00	1.031160D-01	3.999930D 03	1.478750D 05
1.840000D 00	1.003630D 03	1.539960D 02	3.233240D-02	1.634150D-01	1.026880D 00	1.030250D-01	3.999930D 03	1.480040D 05
1.940000D 00	1.004150D 03	1.542980D 02	3.507020D-02	1.633520D-01	1.026490D 00	1.029150D-01	3.999920D 03	1.481280D 05
2.040000D 00	1.004710D 03	1.545890D 02	3.798090D-02	1.632780D-01	1.026030D 00	1.027870D-01	3.999920D 03	1.482480D 05
2.140000D 00	1.005320D 03	1.548690D 02	4.076340D-02	1.631930D-01	1.025500D 00	1.026420D-01	3.999920D 03	1.483640D 05
2.240000D 00	1.005970D 03	1.551390D 02	4.370610D-02	1.630960D-01	1.024890D 00	1.024730D-01	3.999910D 03	1.484760D 05
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2.440000D 00	1.007430D 03	1.556460D 02	4.978490D-02	1.628660D-01	1.023460D 00	1.020800D-01	3.999900D 03	1.486870D 05
2.540000D 00	1.008230D 03	1.558830D 02	5.287460D-02	1.627330D-01	1.022630D 00	1.018520D-01	3.999900D 03	1.487870D 05
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2.740000D 00	1.009970D 03	1.563240D 02	5.922400D-02	1.624290D-01	1.020740D 00	1.013370D-01	3.999890D 03	1.489730D 05
2.840000D 00	1.010920D 03	1.565290D 02	6.245550D-02	1.622580D-01	1.019670D 00	1.010480D-01	3.999890D 03	1.490610D 05
2.940000D 00	1.011930D 03	1.567220D 02	6.571840D-02	1.620740D-01	1.018530D 00	1.007390D-01	3.999880D 03	1.491440D 05
3.040000D 00	1.012980D 03	1.569050D 02	6.900810D-02	1.618760D-01	1.017300D 00	1.004090D-01	3.999880D 03	1.492240D 05
3.140000D 00	1.014090D 03	1.570770D 02	7.231980D-02	1.616650D-01	1.015980D 00	1.000580D-01	3.999880D 03	1.493000D 05
3.240000D 00	1.015250D 03	1.572390D 02	7.564880D-02	1.614400D-01	1.014580D 00	9.968610D-02	3.999870D 03	1.493730D 05
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3.640000D 00	1.020440D 03	1.577830D 02	8.906370D-02	1.603990D-01	1.008090D 00	9.799130D-02	3.999860D 03	1.496270D 05
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4.040000D 00	1.026460D 03	1.581710D 02	1.023390D-01	1.591210D-01	1.000130D 00	9.596990D-02	3.999840D 03	1.498300D 05
4.140000D 00	1.028120D 03	1.582450D 02	1.056120D-01	1.587620D-01	9.978960D-01	9.541500D-02	3.999840D 03	1.498730D 05
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4.440000D 00	1.033350D 03	1.584140D 02	1.152380D-01	1.575950D-01	9.906250D-01	9.364090D-02	3.999830D 03	1.499860D 05
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4.940000D 00	1.043070D 03	1.585420D 02	1.303750D-01	1.553490D-01	9.766260D-01	9.036970D-02	3.999810D 03	1.501230D 05
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5.640000D 00	1.058540D 03	1.584510D 02	1.488210D-01	1.516030D-01	9.532610D-01	8.530740D-02	3.999780D 03	1.502270D 05
5.740000D 00	1.060910D 03	1.584160D 02	1.511370D-01	1.510130D-01	9.495790D-01	8.455270D-02	3.999780D 03	1.502350D 05
5.840000D 00	1.063310D 03	1.583810D 02	1.533510D-01	1.504090D-01	9.458140D-01	8.379240D-02	3.999770D 03	1.502420D 05
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9.640000D 00	1.162920D 03	1.574620D 02	1.510440D-01	1.209700D-01	7.617070D-01	5.782300D-02	3.999620D 03	1.506340D 05
9.740000D 00	1.165270D 03	1.575410D 02	1.485590D-01	1.201240D-01	7.564030D-01	5.732340D-02	3.999620D 03	1.506820D 05
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1.104000D 01	1.191760D 03	1.595310D 02	1.068410D-01	1.093710D-01	6.889330D-01	5.179140D-02	3.999570D 03	1.516620D 05
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1.124000D 01	1.195050D 03	1.600130D 02	9.909440D-02	1.077760D-01	6.789230D-01	5.108540D-02	3.999560D 03	1.518790D 05
1.134000D 01	1.196600D 03	1.602740D 02	9.511170D-02	1.069870D-01	6.739600D-01	5.074560D-02	3.999560D 03	1.519940D 05
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1.164000D 01	1.200890D 03	1.611320D 02	8.277050D-02	1.046520D-01	6.592890D-01	4.977570D-02	3.999550D 03	1.523680D 05
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1.204000D 01	1.205680D 03	1.624620D 02	6.552680D-02	1.016240D-01	6.402610D-01	4.859360D-02	3.999530D 03	1.529310D 05
1.214000D 01	1.206710D 03	1.628280D 02	6.109870D-02	1.008840D-01	6.356070D-01	4.831670D-02	3.999530D 03	1.530830D 05
1.224000D 01	1.207670D 03	1.632080D 02	5.663020D-02	1.001510D-01	6.309990D-01	4.804710D-02	3.999530D 03	1.532400D 05
1.234000D 01	1.208560D 03	1.636010D 02	5.212680D-02	9.942390D-02	6.264260D-01	4.778400D-02	3.999520D 03	1.534010D 05
1.244000D 01	1.209380D 03	1.640090D 02	4.759010D-02	9.870420D-02	6.218590D-01	4.752780D-02	3.999520D 03	1.535670D 05
1.254000D 01	1.210120D 03	1.644240D 02	4.302450D-02	9.799390D-02	6.174310D-01	4.727090D-02	3.999510D 03	1.537380D 05
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1.324000D 01	1.213230D 03	1.677570D 02	1.054620D-02	9.320700D-02	5.873100D-01	4.569980D-02	3.999490D 03	1.550440D 05
1.334000D 01	1.213370D 03	1.682880D 02	5.871770D-03	9.259210D-02	5.831870D-01	4.549630D-02	3.999480D 03	1.552460D 05
1.344000D 01	1.213430D 03	1.688290D 02	1.199860D-03	9.190800D-02	5.791130D-01	4.529810D-02	3.999480D 03	1.554520D 05
1.349600D 01	1.213430D 03	1.691050D 02	-1.134800D-03	9.168650D-02	5.770950D-01	4.520090D-02	3.999480D 03	1.555560D 05
1.359000D 01	1.213370D 03	1.696680D 02	-5.748260D-03	9.096880D-02	5.730910D-01	4.501010D-02	3.999470D 03	1.557660D 05
1.369000D 01	1.213230D 03	1.702440D 02	-1.045260D-02	9.031980D-02	5.691320D-01	4.482400D-02	3.999470D 03	1.559800D 05
1.379000D 01	1.213010D 03	1.708320D 02	-1.509450D-02	8.969920D-02	5.662230D-01	4.464270D-02	3.999460D 03	1.561970D 05



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2.795280 01	7.310100 02	2.7811110 02	-1.201860-01	9.491480-02	3.459830-01	3.762080-02	3.998890 03	1.479870 05
2.719880 01	7.277880 02	2.769570 02	-1.176120-01	9.486270-02	3.465250-01	3.761330-02	3.998890 03	1.478910 05
2.729360 01	7.244730 02	2.758920 02	-1.151810-01	9.481160-02	3.469310-01	3.760610-02	3.998880 03	1.478250 05
2.739080 01	7.213090 02	2.746170 02	-1.123960-01	9.476250-02	3.469210-01	3.739910-02	3.998880 03	1.477610 05
2.748880 01	7.182680 02	2.735320 02	-1.097440-01	9.471690-02	3.469280-01	3.739230-02	3.998870 03	1.476970 05
2.758800 01	7.151710 02	2.723330 02	-1.070760-01	9.466890-02	3.469280-01	3.738580-02	3.998870 03	1.476330 05
2.768800 01	7.121140 02	2.712280 02	-1.043680-01	9.462640-02	3.437460-01	3.737950-02	3.998870 03	1.475710 05
2.778880 01	7.090380 02	2.701110 02	-1.016730-01	9.458130-02	3.436760-01	3.737330-02	3.998860 03	1.475100 05
2.788880 01	7.060120 02	2.691360 02	-9.896880-02	9.453970-02	3.432110-01	3.736740-02	3.998860 03	1.474500 05
2.798880 01	7.029760 02	2.681940 02	-9.616670-02	9.449960-02	3.429570-01	3.736180-02	3.998850 03	1.473910 05
2.808800 01	7.001000 02	2.672540 02	-9.341380-02	9.446090-02	3.427110-01	3.735630-02	3.998850 03	1.473330 05
2.818800 01	6.980870 01	2.663360 02	-9.068190-02	9.442380-02	3.424750-01	3.735100-02	3.998840 03	1.472760 05
2.829600 01	6.980880 02	2.654280 02	-8.798110-02	9.438760-02	3.422470-01	3.734580-02	3.998840 03	1.472200 05
2.839080 01	6.938670 02	2.645280 02	-8.530380-02	9.435360-02	3.420280-01	3.734100-02	3.998830 03	1.471660 05
2.849080 01	6.918830 02	2.636890 02	-8.263770-02	9.431960-02	3.418180-01	3.733630-02	3.998830 03	1.471130 05

PITCH-ANGLE GAIN = 1.000000000000D 00
PITCH-ANGLE BIAS = 0.0.28479957830-17 RADIAN

MODEL SOLUTIONS

MODEL 12	P0 = 2.868500+169810382000 06	CD0 =	3.4972374+229049800-02
	P1 = 0.0	CD1 =	0.0
PCINT	P2 = 1.+126383853500038000 03	CD2 =	1.+3090448882153737780 00
FAILURES	P3 = -2.+179256195392161000 00	CD3 =	0.0
0	P4 = 0.0	CD4 =	1.+990490092e85590100 03

FIT ERROR= 3.0933958888021461D-08

MODEL 12 FOUND TO BE BEST FIT

LIFT COEFFICIENTS BY LEAST SQUARE DISTANCE

CLA0=-0.30bb3552 32J0869D-02
CLA = 0.+3775684+5e0102E2 01
CLAX=-0.+1897e7e1e1+172130 00
EAPX= 0.2063587996+908340 01
CL0= 0.0

ESTIMATED SPECIFIC FUEL CONSUMPTION = 2.52732310+43250-07 LBF/(FT-LBF/SEC)/SEC

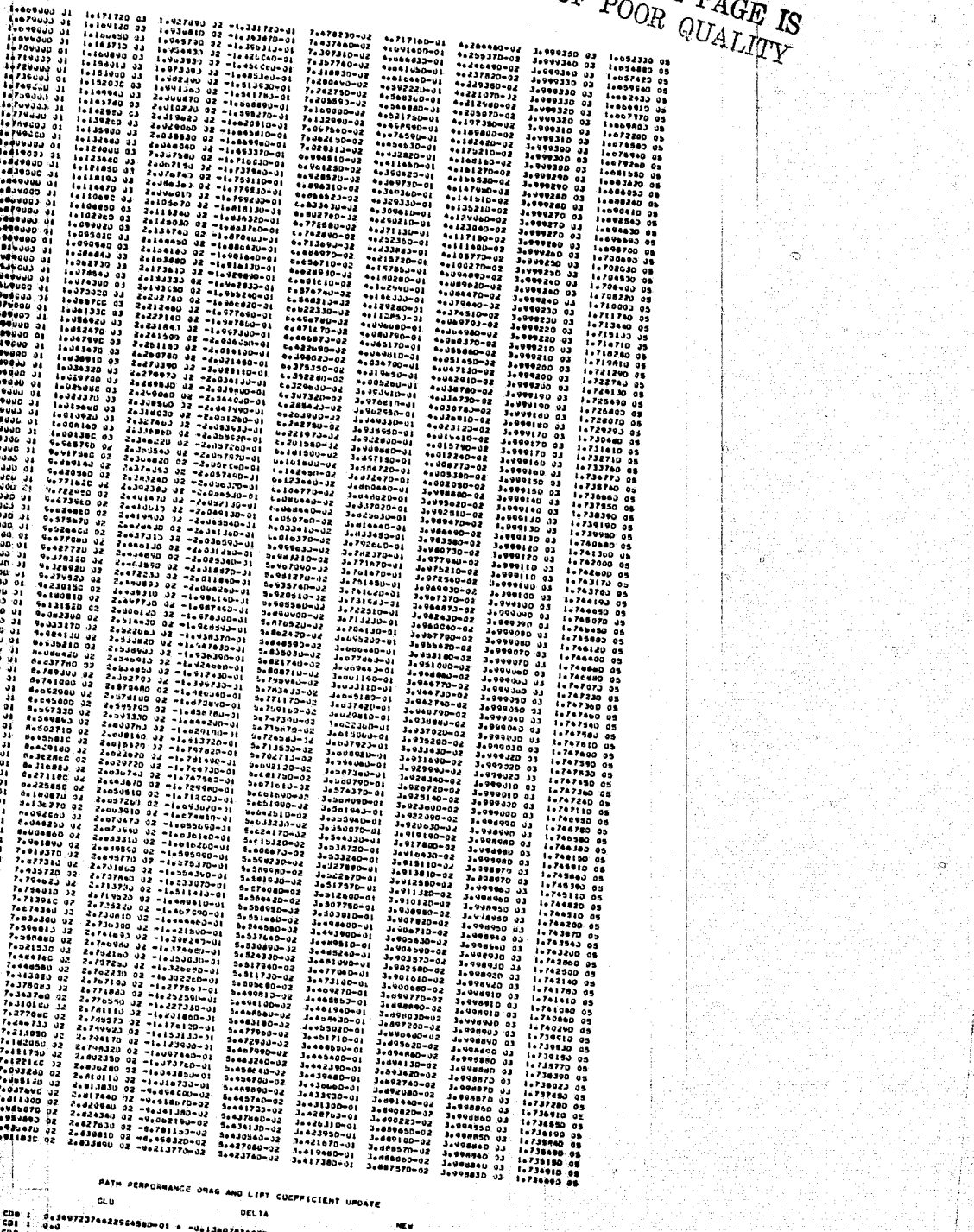
PATH PERFORMANCE ANALYSIS ITERATION NO. 0
(ALTITUDE AND AIRSPEED ASSUMED CORRECT)

PATH PERFORMANCE SUBITERATION 1

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0.0	1.+000000 03	1.+467340 02	5.+424430-03	1.+028040-01	1.+024450 00	1.+067680-01	4.+000000 03	1.+473810 05
1.+000000-02	1.+000000 03	1.+467860 02	1.+128330-04	1.+028110-01	1.+024500 00	1.+067610-01	4.+000000 03	1.+473840 05
2.+000000-02	1.+000000 03	1.+468310 02	1.+756760-04	1.+028170-01	1.+024540 00	1.+067730-01	4.+000000 03	1.+474070 05
3.+000000-02	1.+000000 03	1.+468790 02	2.+945510-04	1.+028240-01	1.+024590 00	1.+067850-01	4.+000000 03	1.+474290 05
4.+000000-02	1.+000000 03	1.+469250 02	3.+3565e0-04	1.+028310-01	1.+024620 00	1.+067970-01	4.+000000 03	1.+474520 05
5.+000000-02	1.+000000 03	1.+470180 02	4.+413440-04	1.+028440-01	1.+024700 00	1.+068210-01	4.+000000 03	1.+474970 05
1.+000000-01	1.+000001 03	1.+471100 02	5.+827160-04	1.+028570-01	1.+024790 00	1.+068440-01	4.+000000 03	1.+475630 05
1.+200000-01	1.+000010 03	1.+472020 02	7.+257590-04	1.+028730-01	1.+024870 00	1.+068680-01	4.+000000 03	1.+475880 05
1.+400000-01	1.+000030 03	1.+472940 02	8.+824440-04	1.+028880-01	1.+024980 00	1.+068910-01	3.+999990 03	1.+476330 05
1.+600000-01	1.+000070 03	1.+473860 02	1.+040750-03	1.+029060-01	1.+025030 00	1.+069130-01	3.+999990 03	1.+476550 05
1.+800000-01	1.+000121 03	1.+474780 02	1.+216710-03	1.+029210-01	1.+025180 00	1.+069350-01	3.+999990 03	1.+476780 05
2.+000000-01	1.+000192 03	1.+475690 02	1.+729700-03	1.+029450-01	1.+025190 00	1.+069580-01	3.+999990 03	1.+477070 05
2.+200000-01	1.+000312 03	1.+477380 02	1.+040750-03	1.+029850-01	1.+025330 00	1.+070010-01	3.+999990 03	1.+478550 05
2.+400000-01	1.+000482 03	1.+479210 02	1.+376160-03	1.+029210-01	1.+025480 00	1.+070430-01	3.+999990 03	1.+479430 05
2.+600000-01	1.+000850 03	1.+481110 02	2.+507C10-03	1.+029910-01	1.+025620 00	1.+070840-01	3.+999990 03	1.+480300 05
2.+800000-01	1.+001670 03	1.+482890 02	2.+928290-03	1.+031J130-01	1.+025760 00	1.+071240-01	3.+999990 03	1.+481160 05
3.+000000-01	1.+002116 03	1.+484620 02	3.+835520-03	1.+030540-01	1.+026010 00	1.+071980-01	3.+999980 03	1.+482870 05
3.+200000-01	1.+003150 03	1.+486310 02	4.+426160-03	1.+030920-01	1.+026250 00	1.+072670-01	3.+999980 03	1.+484550 05
3.+400000-01	1.+004220 03	1.+487950 02	5.+001170-03	1.+031270-01	1.+026470 00	1.+073300-01	3.+999970 03	1.+486200 05
3.+600000-01	1.+005350 03	1.+489760 02	7.+355320-03	1.+031580-01	1.+026660 00	1.+073870-01	3.+999970 03	1.+487820 05
3.+800000-01	1.+006540 03	1.+491350 02	6.+289960-03	1.+031860-01	1.+026840 00	1.+074370-01	3.+999970 03	1.+489420 05
4.+000000-01	1.+007830 03	1.+492970 02	9.+942410-03	1.+032150-01	1.+027020 00	1.+074890-01	3.+999960 03	1.+491375 05
4.+200000-01	1.+009060 03	1.+494580 02	1.+171280-02	1.+032380-01	1.+027180 00	1.+075330-01	3.+999960 03	1.+493260 05
4.+400000-01	1.+010380 03	1.+496120 02	1.+359760-02	1.+032540-01	1.+027260 00	1.+075590-01	3.+999960 03	1.+495110 05
4.+600000-01	1.+011740 03	1.+497630 02	1.+550320-02	1.+032620-01	1.+027310 00	1.+075750-01	3.+999950 03	1.+496910 05
4.+800000-01	1.+013180 03	1.+499050 02	1.+760560-02	1.+032640-01	1.+027320 00	1.+075780-01	3.+999950 03	1.+498660 05
5.+000000-01	1.+014840 03	1.+500290 02	1.+980120-02	1.+032560-01	1.+027290 00	1.+075670-01	3.+999950 03	1.+500360 05
5.+200000-01	1.+016960 03	1.+501430 02	2.+220560-02	1.+032430-01	1.+027190 00	1.+075400-01	3.+999940 03	1.+502010 05
5.+400000-01	1.+019380 03	1.+502260 02	2.+460560-02	1.+032200-01	1.+027050 00	1.+074980-01	3.+999940 03	1.+503600 05
5.+600000-01	1.+022720 03	1.+503360 02	2.+709620-02	1.+031870-01	1.+026853 00	1.+074380-01	3.+999930 03	1.+505140 05
5.+800000-01	1.+026360 03	1.+503830 02	2.+967240-02	1.+031450-01	1.+026580 00	1.+073630-01	3.+999930 03	1.+506630 05
6.+000000-01	1.+029960 03	1.+503980 02	3.+233260-02	1.+030930-01	1.+026260 00	1.+072690-01	3.+999930 03	1.+508070 05
6.+200000-01	1.+033150 03	1.+503960 02	3.+507C20-02	1.+030300-01	1.+025860 00	1.+071550-01	3.+999920 03	1.+509450 05
6.+400000-01	1.+035630 03	1.+503860 02	3.+788090-02	1.+029560-01	1.+025400 00	1.+070270-01	3.+999920 03	1.+510760 05
6.+600000-01	1.+037380 03	1.+503690 02	4.+076C60-02	1.+028710-01	1.+024870 00	1.+068690-01	3.+999920 03	1.+512050 05
6.+800000-01	1.+038570 03	1.+503490 02	4.+370410-02	1.+027750-01	1.+024270 00	1.+066960-01	3.+999910 03	1.+513270 05
7.+000000-01	1.+039440 03	1.+503280 02	4.+670750-02	1.+026660-01	1.+023590 00	1.+065020-01	3.+999910 03	1.+514440 05
7.+200000-01	1.+040430 03	1.+503040 02	4.+976590-02	1.+025460-01	1.+022840 00	1.+062870-01	3.+999900 03	1.+515560 05
7.+400000-01	1.+041830 03	1.+502830 02	5.+287450-02	1.+024130-01	1.+022010 00	1.+060510-01	3.+999900 03	1.+516630 05
7.+600000-01	1.+043670 03	1.+502660 02	5.+602980-02	1.+022680-01	1.+021110 00	1.+057950-01	3.+999900 03	1.+517640 05
7.+800000-01	1.+046070 03	1.+502540 02	5.+922940-02	1.+021110-01	1.+020130 00	1.+055160-01	3.+999890 03	1.+518600 05
8.+000000-01	1.+049020 03	1.+502520 02	6.+245850-02	1.+019430-01	1.+019060 00	1.+052170-01	3.+999890 03	1.+519510 05
8.+200000-01	1.+051930 03	1.+502720 02	6.+571840-02	1.+017570-01	1.+017820 00	1.+048960-01	3.+999880 03	1.+520370 05
8.+400000-01	1.+054940 03	1.+503150 02	6.+900810-02	1.+015600-01	1.+016490 00	1.+045530-01	3.+999880 03	1.+521180 05
8.+600000-01	1.+058090 03	1.+503770 02	7.+231980-02	1.+013383-01	1.+015050 00	1.+041850-01	3.+999870 03	1.+521940 05
8.+800000-01	1.+061390 03	1.+504580 02	7.+565680-02	1.+011200-01	1.+013360 00	1.+037830-01	3.+999870 03	1.+522680 05
9.+000000-01	1.+064870 03	1.+505600 02	7.+904250-02	1.+008850-01	1.+011490 00	1.+033450-01	3.+999870 03	1.+523320 05
9.+200000-01	1.+068540 03	1.+506810 02	8.+246680-02	1.+006360-01	1.+009620 00	1.+028660-01	3.+999870 03	1.+523940 05



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PATH PERFORMANCE DRAG AND LIFT COEFFICIENT UPDATE

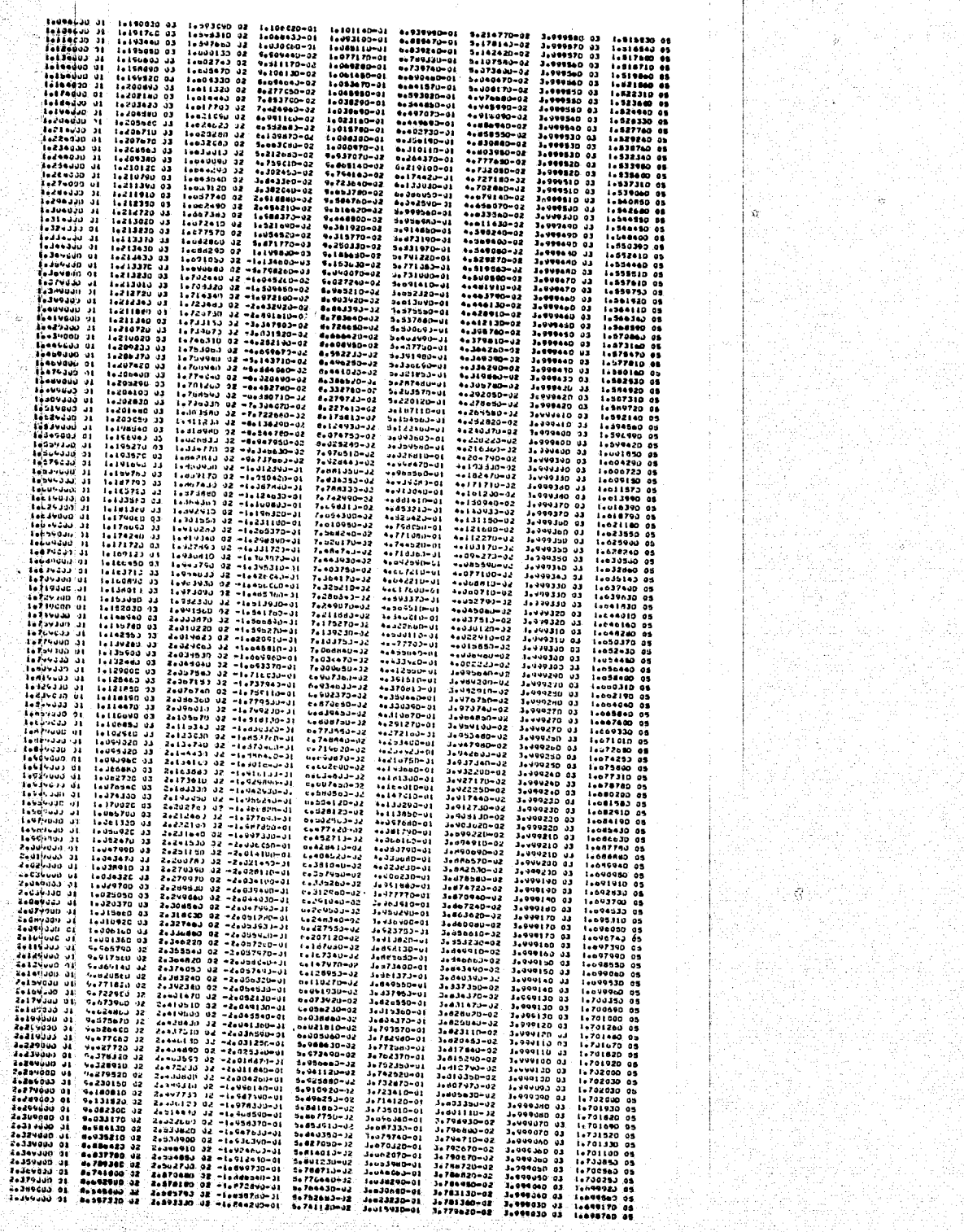
	OLD		DELTA		NEW
CD0 =	0.3697237e+00	+	-0.1360782e-05	=	0.3361169e+00
CD1 =	0.0	+	0.0	=	0.0
CD2 =	0.1533964e+00	+	-0.6879509e-01	=	0.1265488e+00
CD3 =	0.0	+	0.0	=	0.0
CD0 =	0.0	+	0.0	=	0.0
CLA01 =	-0.3080e+00	+	-0.1394e+00	=	-0.4474e+00

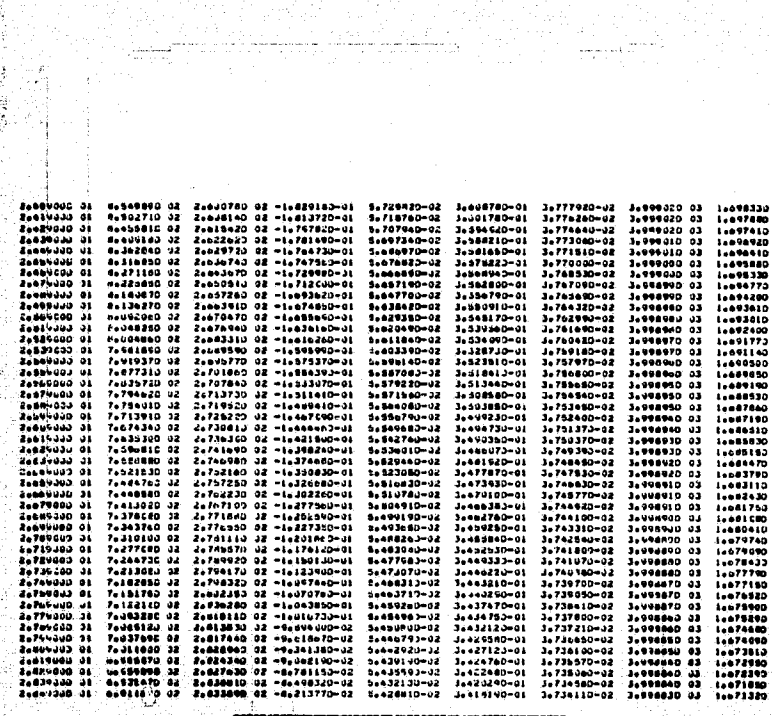
CLA : 0.e377be0965660102E0 01 + -0.138016[illegible]873e-02 = 0.e37e0997E2E0760E1J 31
CLA2: -0.e58077E2E1661721J0 00 + -0.139132e0925757460-01 = -0.e0e0666531E0F76B7D 00

PATH PERFORMANCE SUBITERATION 2

TIME (SECS)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	GAMMA (RAD)	ALPHA (RAD)	CL	CD	WEIGHT (LBF)	POWER (FT-LBF/SEC)
0e0	1.e000000 03	1.e4c7380 02	9.e162630-05	1.e63068e0-01	1.e025180 00	1.e028030-01	9.e03089D 03	1.e449330 05
1.e0e0800-02	1.e000000 03	1.e4c7e83 02	1.e128330-04	1.e630133-01	1.e028140 00	1.e029190-01	9.e300039 03	1.e449330 05
2.e633600-02	1.e000000 03	1.e4c4320 02	1.e75e760-04	1.e632200-01	1.e028180 00	1.e029270-01	9.e000000 03	1.e449730 05
3.e000000-02	1.e000000 03	1.e4ed790 02	2.e398310-04	1.e632270-01	1.e028220 00	1.e029360-01	9.e000000 03	1.e449940 05
4.e0d1440-02	1.e000000 03	1.e4e9250 02	3.e03c5ae-04	1.e632340-01	1.e028270 00	1.e029460-01	9.e000000 03	1.e450140 05
5.e000000-02	1.e000000 03	1.e47018d 02	4.e1134e0-04	1.e630470-01	1.e028330 00	1.e029570-01	9.e000000 03	1.e450340 05
6.e0d0000-02	1.e000000 03	1.e471103 02	5.e27180-04	1.e63869e-01	1.e028400 00	1.e029680-01	9.e000000 03	1.e450540 05
1.e000000-01	1.e000010 03	1.e47202d 02	7.e297930-04	1.e630730-01	1.e028510 00	1.e029818e-01	9.e000000 03	1.e450740 05
1.e233e80-01	1.e004.01d 03	1.e47496d 02	8.e26e460-04	1.e630868-01	1.e028590 00	1.e029e40-01	9.e000990 03	1.e450740 05
1.e466d60-01	1.e003d10 03	1.e4e079d 02	9.e4e079d-04	1.e630998-01	1.e028670 00	1.e029e20-01	9.e000990 03	1.e450740 05
1.e6d0000-01	1.e300d2D 03	1.e4f5e9D 02	1.e3761D-03	1.e631260-01	1.e028830 00	1.e027080-01	9.e000990 03	1.e450740 05
2.e833e80-01	1.e000d30 03	1.e477b1d 02	1.e729790-03	1.e631480-01	1.e025960 00	1.e027470-01	9.e000990 03	1.e453710 05
2.e000d80-01	1.e000d60 04	1.e47931D 02	2.e1d7670-03	1.e631710-01	1.e026130 00	1.e027870-01	9.e000990 03	1.e454490 05
3.e0d0d80-01	1.e000d50 03	1.e4e111D 02	2.e907810-03	1.e631960-01	1.e026270 00	1.e028270-01	9.e000990 03	1.e455260 05
3.e683d80-01	1.e000c70 03	1.e482890 02	2.e928e80-03	1.e632190-01	1.e026410 00	1.e028670-01	9.e000990 03	1.e456030 05
4.e800d80-01	1.e000110 03	1.e4e3e70 02	3.e835020-03	1.e632560-01	1.e026660 00	1.e029370-01	9.e000980 03	1.e457540 05
5.e683d80-01	1.e000180 03	1.e4e9610 02	4.e826180-03	1.e632960-01	1.e026900 00	1.e030030-01	9.e000960 03	1.e459020 05
5.e800d80-01	1.e000220 03	1.e4c3390 02	5.e940170-03	1.e633310-01	1.e027120 00	1.e030660-01	9.e000980 03	1.e460480 05
6.e683d80-01	1.e000360 03	1.e49e7a0 02	7.e0a132D-03	1.e633620-01	1.e027320 00	1.e031190-01	9.e000970 03	1.e461920 05
7.e833e80-01	1.e000360 03	1.e4d3d70 02	8.e2e960-03	1.e633960-01	1.e027490 00	1.e031670-01	9.e000970 03	1.e463330 05
8.e000d80-01	1.e000830 03	1.e4e61f0 02	9.e982610-03	1.e634190-01	1.e027670 00	1.e032180-01	9.e000960 03	1.e464680 05
9.e683d80-01	1.e000e90 03	1.e4e0183 02	1.e171203-02	1.e634623-01	1.e027810 00	1.e032870-01	9.e000960 03	1.e466730 05
1.e800d80 00	1.e000880 03	1.e4f2c90 02	1.e3697e0-02	1.e634880-01	1.e027910 00	1.e032880-01	9.e000960 03	1.e468360 05
1.e966e80 00	1.e001180 03	1.e4e15d0 02	1.e4e612d0-02	1.e635070-01	1.e027970 00	1.e033040-01	9.e000960 03	1.e469960 05
1.e966d80 00	1.e001360 03	1.e4e9e80 02	1.e7695e0-02	1.e634e80-01	1.e027980 00	1.e033060-01	9.e000960 03	1.e471500 05
1.e966d80 00	1.e001640 03	1.e4f2890 02	1.e9901d0-02	1.e634e30-01	1.e027960 00	1.e032930-01	9.e000950 03	1.e473010 05
1.e966d80 00	1.e001963 03	1.e4d2e80 02	2.e2d9e40-02	1.e634e80-01	1.e027e50 00	1.e032e70-01	9.e000940 03	1.e474470 05
1.e966d80 00	1.e002120 03	1.e4d3d60 02	2.e4e0360-02	1.e634e30-01	1.e027760 00	1.e032270-01	9.e000940 03	1.e475890 05
1.e966d80 00	1.e002720 03	1.e53e4e0 02	2.e709e20-02	1.e63502e-01	1.e027200 00	1.e031760-01	9.e000930 03	1.e477260 05
1.e96e380 00	1.e003180 03	1.e53e630 02	2.e987360-02	1.e633b00-01	1.e027240 00	1.e031670-01	9.e000930 03	1.e478590 05
1.e963680 00	1.e003630 03	1.e53e960 02	3.e233840-02	1.e632970-01	1.e026910 00	1.e033080-01	9.e000830 03	1.e479880 05
1.e966d80 00	1.e006180 03	1.e542980 02	3.e587020-02	1.e632360-01	1.e026820 00	1.e028970-01	9.e09e820 03	1.e481130 05
2.e000d80 00	1.e006710 03	1.e548e80 02	3.e798e90-02	1.e631e00-01	1.e026e00 00	1.e027e90-01	9.e000920 03	1.e482330 05
2.e166d80 00	1.e007230 03	1.e54e880 02	4.e076240-02	1.e630750-01	1.e026b20 00	1.e028e31-01	9.e000910 03	1.e483490 05
2.e263d80 00	1.e007e50 03	1.e551390 02	4.e370410-02	1.e62f9b0-01	1.e026960 00	1.e029560-01	9.e000910 03	1.e484600 05
2.e366d80 00	1.e008660 03	1.e5e3980 02	4.e670750-02	1.e62e690-01	1.e026260 00	1.e022670-01	9.e000910 03	1.e485640 05
2.e463d80 00	1.e009430 03	1.e5be6e0 02	4.e978630-02	1.e62760d-01	1.e026e90 00	1.e02e610-01	9.e000900 03	1.e486710 05
2.e566d80 00	1.e009e30 03	1.e5b9e30 02	5.e287490-02	1.e62e160-01	1.e022660 00	1.e01e360-01	9.e000900 03	1.e487710 05
2.e666d80 00	1.e009e70 03	1.e5ae1d90 02	5.e6e028B0-02	1.e62e750-01	1.e021750 00	1.e019860-01	9.e000900 03	1.e488660 05
2.e766d80 00	1.e00e670 03	1.e5e3240 02	5.e9e824d0-02	1.e623120-01	1.e023770 00	1.e013180-01	9.e999890 03	1.e489570 05
2.e866d80 00	1.e010920 03	1.e5e4290 02	6.e265880-02	1.e621410-01	1.e019700 00	1.e01d300-01	9.e999890 03	1.e490450 05
2.e966d80 00	1.e011e30 03	1.e5e7220 02	6.e571840-02	1.e619670-01	1.e019850 00	1.e037200-01	9.e999840 03	1.e491240 05
3.e066d80 00	1.e012e80 03	1.e5e65e0 02	6.e900810-02	1.e617e00-01	1.e017320 00	1.e003900-01	9.e999880 03	1.e492060 05
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3.e263d80 00	1.e01825D 03	1.e572390 02	7.e564e60-02	1.e613d60-01	1.e01e410 00	9.e9e750e-02	3.e999870 03	1.e493570 05
3.e366d80 00	1.e016e70 03	1.e573900 02	7.e896d20-02	1.e6109e0-01	1.e01312D 00	9.e27e90-02	3.e999870 03	1.e494260 05
3.e466d80 00	1.e017763 03	1.e575312 02	8.e236d30-02	1.e60e830-01	1.e011e60 00	9.e88e1e0-02	3.e999870 03	1.e494910 05
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3.e666d80 00	1.e020440 03	1.e577833 02	8.e904370-02	1.e602e90-01	1.e008120 00	9.e797360-02	3.e999860 03	1.e496120 05
3.e766d80 00	1.e021870 03	1.e578e90 02	9.e238e80-02	1.e59e850-01	1.e00e470 00	9.e746e80-02	3.e999850 03	1.e496670 05
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3.e966d80 00	1.e024e60 03	1.e580e80 02	9.e906e90-02	1.e59d530-01	1.e003290 00	9.e648f20-02	3.e999840 03	1.e497660 05
4.e066d80 00	1.e026170 03	1.e584170 02	9.e2333e0-01	1.e590280-01	1.e000120 00	9.e59e320-02	3.e999840 03	1.e498100 05
4.e166d80 00	1.e028120 03	1.e5d2e50 02	1.e03c120-01	1.e58e50D-01	9.e979260-01	9.e336720-02	3.e999840 03	1.e498580 05
4.e263d80 00	1.e029810 03	1.e5e8150 02	1.e08e5d0-01	1.e582770-01	9.e953670-01	9.e482e50-02	3.e999830 03	1.e498980 05
4.e366d80 00	1.e031960 03	1.e5f3e60 02	1.e120e70-01	1.e57de90-01	9.e931720-01	9.e42d200-02	3.e999830 03	1.e499360 05
4.e466d80 00	1.e033150 03	1.e5e6150 02	1.e1623e0-01	1.e576450-01	9.e90e620-01	9.e362330-02	3.e999830 03	1.e499710 05
4.e566d80 00	1.e035200 03	1.e5e8e50 02	1.e183e60-01	1.e570fe0-01	9.e8d837D-01	9.e29e280-02	3.e999820 03	1.e500030 05
4.e666d80 00	1.e037100 03	1.e5d4e80 02	1.e214e90-01	1.e56e320-01	9.e853e90-01	9.e238790-02	3.e999820 03	1.e500330 05
4.e766d80 00	1.e039e40 03	1.e5e9130 02	1.e244e10-01	1.e56e130-01	9.e825e80-01	9.e170290-02	3.e999820 03	1.e500600 05
4.e866d80 00	1.e041030 03	1.e5f5310 02	1.e276570-01	1.e557200-01	9.e79e950-01	9.e104e20-02	3.e999810 03	1.e500884 05
4.e966d80 00	1.e042e70 03	1.e5e5e20 02	1.e307750-01	1.e552e20-01	9.e76e510-01	9.e035260-02	3.e999810 03	1.e501080 05
5.e063d80 00	1.e045150 03	1.e5e5e60 02	1.e332290-01	1.e54e960-01	9.e73e770-01	9.e9e890-02	3.e999810 03	1.e501290 05
5.e163d80 00	1.e047290 03	1.e5d5660 02	1.e360100-01	1.e542630-01	9.e7341e0-01	8.e95e610-02	3.e999830 03	1.e501470 05
5.e263d80 00	1.e049e00 03	1.e5d5de0 02	1.e387320-01	1.e537220-01	9.e7176D0-01	8.e823e90-02	3.e999800 03	1.e501640 05
5.e363d80 00	1.e051670 03	1.e5d8230 02	1.e413750-01	1.e531870-01	9.e636220-01	8.e75142e-02	3.e999790 03	1.e501793 05
5.e463d80 00	1.e053e20 03	1.e5d5d60 02	1.e439250-01	1.e52e380-01	9.e60d7e0-01	8.e670f0-02	3.e999790 03	1.e501920 05
5.e563d80 00	1.e056210 03	1.e5e6e80 02	1.e464230-01	1.e5f076d-01	9.e5e883D-01	8.e603960-02	3.e999780 03	1.e502030 05
5.e663d80 00	1.e058e40 03	1.e5d4910 02	1.e488210-01	1.e5f0d3d-01	9.e532e80-01	8.e549100-02	3.e999790 03	1.e502130 05
5.e763d80 00	1.e060910 03	1.e5e6180 02	1.e511320-01	1.e509110-01	9.e496e60-01	8.e453e40-02	3.e999790 03	1.e502210 05
5.e863d80 00	1.e062310 04	1.e5e9e10 02	1.e533510-01	1.e503080-01	9.e45e3e0-01	8.e377e20-02	3.e999770 03	1.e502283 05
5.e963d80 00	1.e063750 03	1.e5e3420 02	1.e5547e0-01	1.e4f9e20-01	9.e41e600-01	8.e3011e0-02	3.e999770 03	1.e502330 05
6.e063d80 00	1.e066220 03	1.e5e2e60 02	1.e575e40-01	1.e490e30-01	9.e3d0e00-01	8.e226240-02	3.e999760 03	1.e502380 05
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6.e263d80 00	1.e07324e0 03	1.e5c1960 02	1.e615750-01	1.e477e70-01	9.e299e20-01	8.e0e9e30-02	3.e999760 03	1.e502430 05
6.e363d80 00	1.e075790 03	1.e5e14e0 02	1.e6357d0-01	1.e471010-01	9.e257690-01	7.e92110-02	3.e999760 03	1.e502463 05
6.e463d80 00	1.e078370 03	1.e5b0920 02	1.e655870-01	1.e4642d0-01	9.e21be30-01	7.e914e60-02	3.e999750 03	1.e502480 05
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6.e663d80 00	1.e083e30 03	1.e579700 02	1.e674780-01	1.e4d0360-01	9.e12e810-01	7.e759760-02	3.e999740 03	1.e502490 05
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7.e163d80 00	1.e096e70 03	1.e576e60 02	1.e726543-01	1.e413663-01	8.e900e50-01	7.e378140-02	3.e999720 03	1.e502400 05
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7.e363d80 00	1.e102410 03	1.e57576D 02	1.e738720-01	1.e3986e0-01	8.e805e40-01	7.e229e60-02	3.e999710 03	1.e502380 05
7.e463d80 00	1.e105140 03	1.e57522D 02	1.e742930-01	1.e390820-01	8.e757080-01	7.e156940-02	3.e999710 03	1.e502380 05
7.e563d80 00	1.e107e70 03	1.e57e760 02	1.e746860-01	1.e383110-01	8.e70e260-01	7.e082620-02	3.e999710 03	1.e502380 05
7.e663d80 00	1.e110810 03	1.e574300 02	1.e747520-01	1.e375240-01	8.e63e690-01	7.e010840-02	3.e999730 03	1.e502390 05
7.e763d80 00	1.e113e40 03	1.e5f730 02	1.e747e80-01	1.e367300-01	8.e0e0300-01	6.e939e40-02	3.e999700 03	1.e502410 05
7.e863d80 00	1.e116980 03	1.e573300 02	1.e746e70-01	1.e359230-01	8.e5e7230-01	6.e866e20-02	3.e999720 03	1.e502460 05
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8.e663d80 00	1.e137e90 03	1.e571330 02	1.e692753-01	1.e293510-01	8.e141e10-01	6.e342310-02	3.e999660 03	1.e503210 05
8.e763d80 00	1.e140e20 03	1.e571320 02	1.e680170-01	1.e285120-01	8.e094e30-01	6.e281e80-02	3.e999660 03	1.e503360 05
8.e863d80 00	1.e142940 03	1.e571340 02	1.e66e280-01	1.e27e710-01	8.e341810-01	6.e221e00-02	3.e999660 03	1.e503590 05
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9.e063d80 00	1.e148110 03	1.e571720 02	1.e636700-01	1.e259820-01	7.e935670-01	6.e104340-02	3.e999650 03	1.e504080 05
9.e163d80 00	1.e150e50 03	1.e572060 02	1.e617030-01	1.e251360-01	7.e88e910-01	6.e047e80-02	3.e999e50 03	1.e504360 05
9.e263d80 00	1.e153570 03	1.e572550 02	1.e598130-01	1.e242e40-01	7.e841e80-01	5.e992e40-02	3.e999640 03	1.e504660 05
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9.e563d80 00	1.e163e60 03	1.e573920 02	1.e536140-01	1.e217e70-01	7.e7035a-01	5.e832140-02	3.e999630 03	1.e505800 05
9.e663d80 00	1.e167980 03	1.e57ee20 02	1.e513e40-01	1.e209d80-01	7.e617e00-01	5.e781070-02	3.e999630 03	1.e506250 05
9.e763d80 00	1.e172e70 03	1.e57e410 02	1.e4d55e0-01	1.e2005b0-01	7.e5e919e-01	5.e731120-02	3.e999620 03	1.e506750 05
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1.e028d80 01	1.e17e420 03	1.e580e80 02	1.e4e681b-01	1.e166570-01	7.e330f2D-01	5.e497870-02	3.e999600 03	1.e509670 05
1.e036e30 01	1.e178820 03	1.e582e60 02	1.e4b3510-01	1.e15d2e0-01	7.e2e882D-01	5.e454e30-02	3.e999600 03	1.e510370 05
1.e044e80 01	1.e180e60 03	1.e583770 02	1.e481230-01	1.e14f9d0-01	7.e19e52D-01	5.e412e20-02	3.e999600 03	1.e511120 05
1.e054e80 01	1.e182e6C 03	1.e586e40 02	1.e4e7660-01	1.e137730-01	7.e164730-01	5.e378630-02	3.e999590 03	1.e511e20 05
1.e064e80 01	1.e184e80 03	1.e5d7150 02	1.e4f1820-01	1.e1d5b20-01	7.e0e1f70-01	5.e338e80-02	3.e999590 03	1.e512e80 05
1.e074e80 01	1.e186810 03	1.e5e9810 02	1.e1797b0-01	1.e117380-01	7.e0e1880-01	5.e298790-02	3.e999e90 03	1.e513e20 05
1.e084e80 01	1.e18d2e0 03	1.e5e2e90 02	1.e462e0-01	1.e108230-01	6.e990790-01	5.e258310-02	3.e999e90 03	1.e514e60 05

ORIGINAL PAGE IS
OF POOR QUALITY





```
 PITCH-ANGLE GAIN =  1.0000000000000 00
 PITCH-ANGLE BIAS =  9.5231429930E0-17 RADIAN
```

M O D E L S O L U T I O N S

```
*                                                                              *
* MODEL 12    P0 =  2.6633024263093636D 04    CD0 =  3.6498461186074925D-02  *
*             P1 =  0.0                       CD1 =  0.0                     *
* FCINT       P2 =  1.4285959343297666D 03    CD2 =  1.3081862733928220D 00  *
* FAILURES    P3 =  -2.1767207478U3263D 00    CD3 =  0.0                     *
* = 0         P4 =  0.0                       CD4 =  2.0027622823851000D 03  *
*                                                                              *
* FIT ERROR=  1.5266750b63985u50D-04                                           *
*                                                                              *
*                                                                              *
*                                                                              *
00                      MODEL 12 FOUND TO BE BEST FIT                          00
*                                                                              *
*                                                                              *
```

LIFT COEFFICIENTS: BY LEAST SQUARE DISTANCE

```
CLA0=0.2F918d8a62J857J4D-02
CLA = 0.t37691924937147J0 01
CLAAA=0.+3086369784b8e593 J0
EXP= 0.d08207460J0J21e40 01
CL0= 0.0
```

ESTIMATED SPECIFIC FUEL CONSUMPTION = 2.527093599440370-07 LBF/(FT-LBF/SEC)/SEC

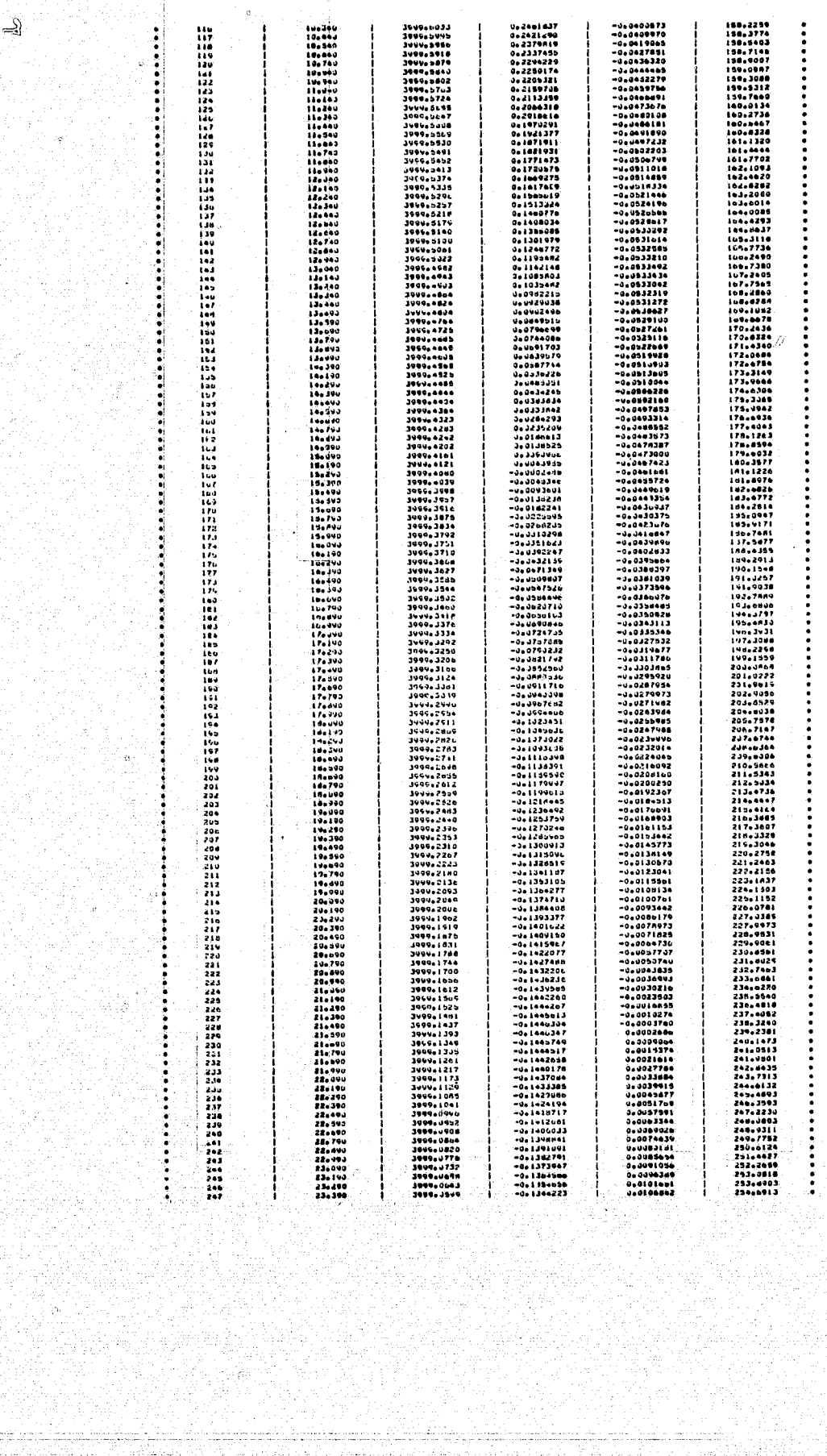
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*BEST* MODEL FIT ERROR =  1.526975959936856b00-04
*BEST* SPECIFIC FUEL CONSUMPTION =  2.5270F3999440370-07 LBF/(FT-LBF/SEC)/SEC
```

```
//*************************************************************************//
//*                                                                       *//
//*  INTERMEDIATE    GENERAL EXPRESSIONS FOR POWER, DRAG COEFFICIENT, AND LIFT COEFFICIENT    *//
//*                                                                       *//
//*    P = P0 + P1*V00 3.333000D-01 + P2*V00 1.000000 00 + P3*V00 2.000000 00 + P4*V00 3.000000 00  *//
//*                                                                       *//
//*                    CD = CD0 + CD1*AAA 1 + CD2*AAA 2 + CD3*AAA 3 + CD4*AAA 4    *//
//*                                                                       *//
//*                       CL = CLA0 + CLA*A + CLA*AAA 2.000000 00 + CL0*R    *//
//*                                                                       *//
//*                                                                       *//
//*    WHERE:                                                             *//
//*                                                                       *//
//*          V = AIRSPEED(FT/SEC)                                         *//
//*          A = ANGLE OF ATTACK(RADIAN)                                  *//
//*          R = PITCH RATE(RADIAN/SEC)                                   *//
//*                                                                       *//
//*          P0 =  0.2863J0242630 05      CD0 =  0.3498461186U10-01    CLA0 = -0.2891e86e6283-02  *//
//*          P1 =  0.0                    CD1 =  0.0                   CLA  =  0.t37691924933 01  *//
//*          P2 =  0.1112d0498J6J 00      CD2 =  0.134815827360 01     CLAA = -0.30383697850 00   *//
//*          P3 = -0.217372076790 01      CD3 =  0.0                   CL0  =  0.0                *//
//*          P4 =  0.0                    CD4 =  0.2J0276228320 06                                *//
//*                                                                       *//
//*************************************************************************//
```

ORIGINAL PAGE IS
OF POOR QUALITY

MODIFIED DATA (PLN PROGRAM LOOP 1)

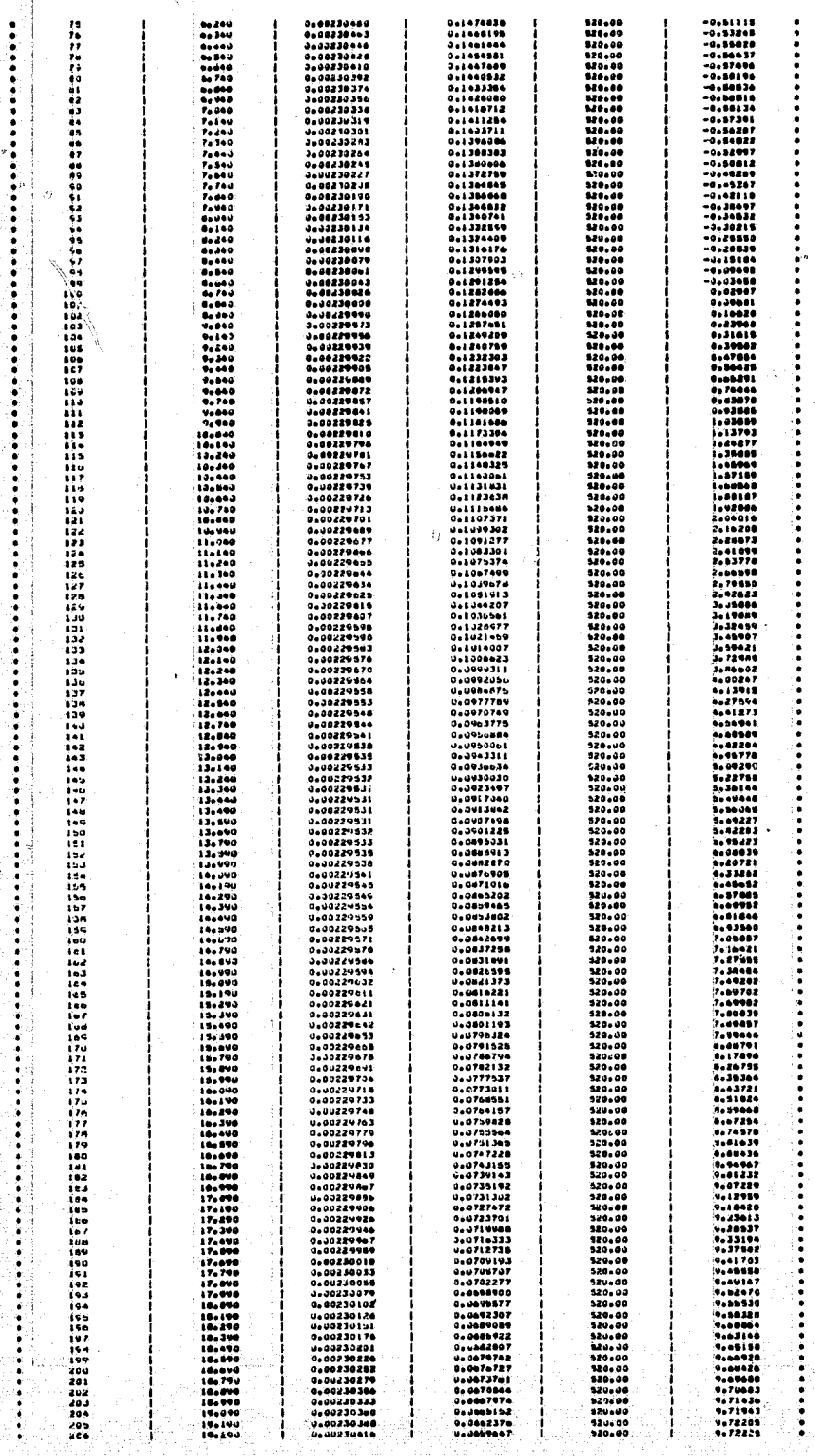
DATA POINT	TIME (SECS)	HEIGHT (FT)	PITCH ANGLE (RADIANS)	PITCH RATE (RADIAN/SEC)	AIRSPEED (FT/SEC)
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2	0e0510	3999e+0503	0e1b27e4e	0e036f863	14de7858
3	0e052	3999e+0509	0e1e28f85	0e0070259	14de8322
4	0e053	3999e+0502	0e1e29095	0e007e651	14de8787
5	0e053	3999e+0502	0e1e29819	0e0073041	14de9251
6	0e053	3999e+0502	0e1e31306	0e007e812	14e7e179
7	0e053	3999e+0502	0e1e31853	0e007e871	14e7e179
8	0e120	3999e+0502	0e1e34e52	0e0073041	14e7e643
9	0e120	3999e+0502	0e1e3e1f	0e0074e23	14e7e2965
10	0e120	3999e+0502	0e1e37817	0e0076777	14e7e8e2
11	0e120	3999e+0502	0e1e41f38	0e0074e87	14e7e8e6
12	0e120	3999e+0502	0e1e43196	0e0074ad	14e7e9ca
13	0e120	3999e+0502	0e1e44e36	0e0074e9	14e7e9ca
14	0e120	3999e+0502	0e1e46e2e	0e0074e9	14e7e9ca
15	0e120	3999e+0502	0e1e48e2e	0e0074e9	14e7e9ca
16	0e120	3999e+0502	0e1e4ae2e	0e0074e9	14e7e9ca
17	0e120	3999e+0502	0e1e4ce2e	0e0074e9	14e7e9ca
18	0e120	3999e+0502	0e1e4ee2e	0e0074e9	14e7e9ca
19	0e120	3999e+0502	0e1e50e2e	0e0074e9	14e7e9ca
20	0e120	3999e+0502	0e1e52e2e	0e0074e9	14e7e9ca
21	0e120	3999e+0502	0e1e54e2e	0e0074e9	14e7e9ca
22	0e120	3999e+0502	0e1e56e2e	0e0074e9	14e7e9ca
23	0e120	3999e+0502	0e1e58e2e	0e0074e9	14e7e9ca
24	0e120	3999e+0502	0e1e5ae2e	0e0074e9	14e7e9ca
25	0e120	3999e+0502	0e1e5ce2e	0e0074e9	14e7e9ca
26	0e120	3999e+0502	0e1e5ee2e	0e0074e9	14e7e9ca
27	0e120	3999e+0502	0e1e60e2e	0e0074e9	14e7e9ca
28	0e120	3999e+0502	0e1e62e2e	0e0074e9	14e7e9ca
29	0e120	3999e+0502	0e1e64e2e	0e0074e9	14e7e9ca
30	0e120	3999e+0502	0e1e66e2e	0e0074e9	14e7e9ca
31	0e120	3999e+0502	0e1e68e2e	0e0074e9	14e7e9ca
32	0e120	3999e+0502	0e1e6ae2e	0e0074e9	14e7e9ca
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34	0e120	3999e+0502	0e1e6ee2e	0e0074e9	14e7e9ca
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38	0e120	3999e+0502	0e1e76e2e	0e0074e9	14e7e9ca
39	0e120	3999e+0502	0e1e78e2e	0e0074e9	14e7e9ca
40	0e120	3999e+0502	0e1e7ae2e	0e0074e9	14e7e9ca
41	0e120	3999e+0502	0e1e7ce2e	0e0074e9	14e7e9ca
42	0e120	3999e+0502	0e1e7ee2e	0e0074e9	14e7e9ca
43	0e120	3999e+0502	0e1e80e2e	0e0074e9	14e7e9ca
44	0e120	3999e+0502	0e1e82e2e	0e0074e9	14e7e9ca
45	0e120	3999e+0502	0e1e84e2e	0e0074e9	14e7e9ca
46	0e120	3999e+0502	0e1e86e2e	0e0074e9	14e7e9ca
47	0e120	3999e+0502	0e1e88e2e	0e0074e9	14e7e9ca
48	0e120	3999e+0502	0e1e8ae2e	0e0074e9	14e7e9ca
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52	0e120	3999e+0502	0e1e92e2e	0e0074e9	14e7e9ca
53	0e120	3999e+0502	0e1e94e2e	0e0074e9	14e7e9ca
54	0e120	3999e+0502	0e1e96e2e	0e0074e9	14e7e9ca
55	0e120	3999e+0502	0e1e98e2e	0e0074e9	14e7e9ca
56	0e120	3999e+0502	0e1e9ae2e	0e0074e9	14e7e9ca
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58	0e120	3999e+0502	0e1e9ee2e	0e0074e9	14e7e9ca
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61	0e120	3999e+0502	0e1ea4e2e	0e0074e9	14e7e9ca
62	0e120	3999e+0502	0e1ea6e2e	0e0074e9	14e7e9ca
63	0e120	3999e+0502	0e1ea8e2e	0e0074e9	14e7e9ca
64	0e120	3999e+0502	0e1eaae2e	0e0074e9	14e7e9ca
65	0e120	3999e+0502	0e1eace2e	0e0074e9	14e7e9ca
66	0e120	3999e+0502	0e1eaee2e	0e0074e9	14e7e9ca
67	0e120	3999e+0502	0e1eb0e2e	0e0074e9	14e7e9ca
68	0e120	3999e+0502	0e1eb2e2e	0e0074e9	14e7e9ca
69	0e120	3999e+0502	0e1eb4e2e	0e0074e9	14e7e9ca
70	0e120	3999e+0502	0e1eb6e2e	0e0074e9	14e7e9ca
71	0e120	3999e+0502	0e1eb8e2e	0e0074e9	14e7e9ca
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83	0e120	3999e+0502	0e1ed0e2e	0e0074e9	14e7e9ca
84	0e120	3999e+0502	0e1ed2e2e	0e0074e9	14e7e9ca
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99	0e120	3999e+0502	0e1ef0e2e	0e0074e9	14e7e9ca
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103	0e120	3999e+0502	0e1ef8e2e	0e0074e9	14e7e9ca
104	0e120	3999e+0502	0e1efae2e	0e0074e9	14e7e9ca
105	0e120	3999e+0502	0e1efce2e	0e0074e9	14e7e9ca
106	0e120	3999e+0502	0e1efee2e	0e0074e9	14e7e9ca
107	0e120	3999e+0502	0e1f0e2e	0e0074e9	14e7e9ca
108	0e120	3999e+0502	0e1f2e2e	0e0074e9	14e7e9ca
109	0e120	3999e+0502	0e1f4e2e	0e0074e9	14e7e9ca
110	0e120	3999e+0502	0e1f6e2e	0e0074e9	14e7e9ca
111	0e120	3999e+0502	0e1f8e2e	0e0074e9	14e7e9ca
112	0e120	3999e+0502	0e1fae2e	0e0074e9	14e7e9ca
113	0e120	3999e+0502	0e1fce2e	0e0074e9	14e7e9ca
114	0e120	3999e+0502	0e1fee2e	0e0074e9	14e7e9ca
115	0e120	3999e+0502	0e20e2e	0e0074e9	14e7e9ca
116	0e120	3999e+0502	0e22e2e	0e0074e9	14e7e9ca
117	0e120	3999e+0502	0e24e2e	0e0074e9	14e7e9ca
118	0e120	3999e+0502	0e26e2e	0e0074e9	14e7e9ca
119	0e120	3999e+0502	0e28e2e	0e0074e9	14e7e9ca



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DATA POINT	TIME (SECS)	DENSITY (SLUG/FT**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-R)	ACCELERATION (FT/SEC**2)
1	0.0	0.00230978	0.1620492	520.00	4.000000
2	0.010	0.00230978	0.1620490	520.03	4.005828
3	0.020	0.00230978	0.1620648	520.00	4.003247
4	0.030	0.00230978	0.1620698	520.00	4.004663
5	0.040	0.00230978	0.1620762	520.00	4.004074
6	0.050	0.00230978	0.1620895	520.00	4.002884
7	0.060	0.00230978	0.1627026	520.00	4.001679
8	0.080	0.00230978	0.1627155	520.00	4.000458
9	0.100	0.00230978	0.1627283	520.00	4.000221
10	0.120	0.00230978	0.1627409	520.00	4.000000
11	0.140	0.00230978	0.1627666	520.00	4.000000
12	0.160	0.00230978	0.1627789	520.00	4.000129
13	0.180	0.00230978	0.1628129	520.00	4.000000
14	0.200	0.00230977	0.1628355	520.00	4.000000
15	0.220	0.00230977	0.1628575	520.00	4.000000
16	0.240	0.00230977	0.1628988	520.00	4.000000
17	0.260	0.00230977	0.1629269	520.00	4.000000
18	0.280	0.00230977	0.1629715	520.00	4.000000
19	0.300	0.00230976	0.1630027	520.00	4.000000
20	0.320	0.00230976	0.1630304	520.00	4.000000
21	0.340	0.00230975	0.1630693	520.00	3.996765
22	0.360	0.00230974	0.1630817	520.00	3.997302
23	0.380	0.00230973	0.1630976	520.00	3.977989
24	0.400	0.00230972	0.1631084	520.00	3.958448
25	0.420	0.00230970	0.1631082	520.00	3.958888
26	0.440	0.00230969	0.1631088	520.00	3.958735
27	0.460	0.00230967	0.1630874	520.00	3.958604
28	0.480	0.00230964	0.1630862	520.00	3.958314
29	0.500	0.00230962	0.1630317	520.00	3.957884
30	0.520	0.00230958	0.1629897	520.00	3.957331
31	0.540	0.00230956	0.1629376	520.00	2.940675
32	0.560	0.00230953	0.1628749	520.00	2.859034
33	0.580	0.00230950	0.1628013	520.00	2.791425
34	0.600	0.00230946	0.1627164	520.00	2.664200
35	0.620	0.00230942	0.1626200	520.00	2.541373
36	0.640	0.00230937	0.1625119	520.00	2.421644
37	0.660	0.00230932	0.1623919	520.00	2.315555
38	0.680	0.00230927	0.1622597	520.00	2.209880
39	0.700	0.00230922	0.1621151	520.00	2.209681
40	0.720	0.00230916	0.1619579	520.00	1.498880
41	0.740	0.00230910	0.1617880	520.00	1.498285
42	0.760	0.00230904	0.1616050	520.00	1.277564
43	0.780	0.00230897	0.1614085	520.00	1.068980
44	0.800	0.00230890	0.1611981	520.00	1.068316
45	0.820	0.00230882	0.1609759	520.00	1.068170
46	0.840	0.00230874	0.1607387	520.00	1.059960
47	0.860	0.00230866	0.1604874	520.00	1.059902
48	0.880	0.00230857	0.1602219	520.00	1.052613
49	0.900	0.00230848	0.1599418	520.00	1.052469
50	0.920	0.00230839	0.1596470	520.00	1.046281
51	0.940	0.00230829	0.1593373	520.00	1.040760
52	0.960	0.00230819	0.1590126	520.00	0.674463
53	0.980	0.00230809	0.1586721	520.00	0.78338
54	1.000	0.00230798	0.1583163	520.00	0.698655
55	1.020	0.00230787	0.1579450	520.00	0.698811
56	1.040	0.00230775	0.1575585	520.00	0.526613
57	1.060	0.00230763	0.1571567	520.00	0.442269
58	1.080	0.00230751	0.1567396	520.00	0.36388
59	1.100	0.00230739	0.1563082	520.00	0.28777
60	1.120	0.00230726	0.1558617	520.00	0.211444
61	1.140	0.00230713	0.1554005	520.00	0.136395
62	1.160	0.00230698	0.1549249	520.00	0.07639
63	1.180	0.00230686	0.1544348	520.00	0.01181
64	1.200	0.00230671	0.1539306	520.00	-0.06973
65	1.220	0.00230657	0.1534122	520.00	-0.10817
66	1.240	0.00230642	0.1528798	520.00	-0.16345
67	1.260	0.00230627	0.1523337	520.00	-0.21553
68	1.280	0.00230612	0.1517738	520.00	-0.26434
69	1.300	0.00230596	0.1512003	520.00	-0.30986
70	1.320	0.00230580	0.1506136	520.00	-0.35208
71	1.340	0.00230564	0.1500122	520.00	-0.38876
72	1.360	0.00230547	0.1493999	520.00	-0.42809
73	1.380	0.00230531	0.1487736	520.00	-0.45798
74	1.400	0.00230468	0.1481340	520.00	-0.48831

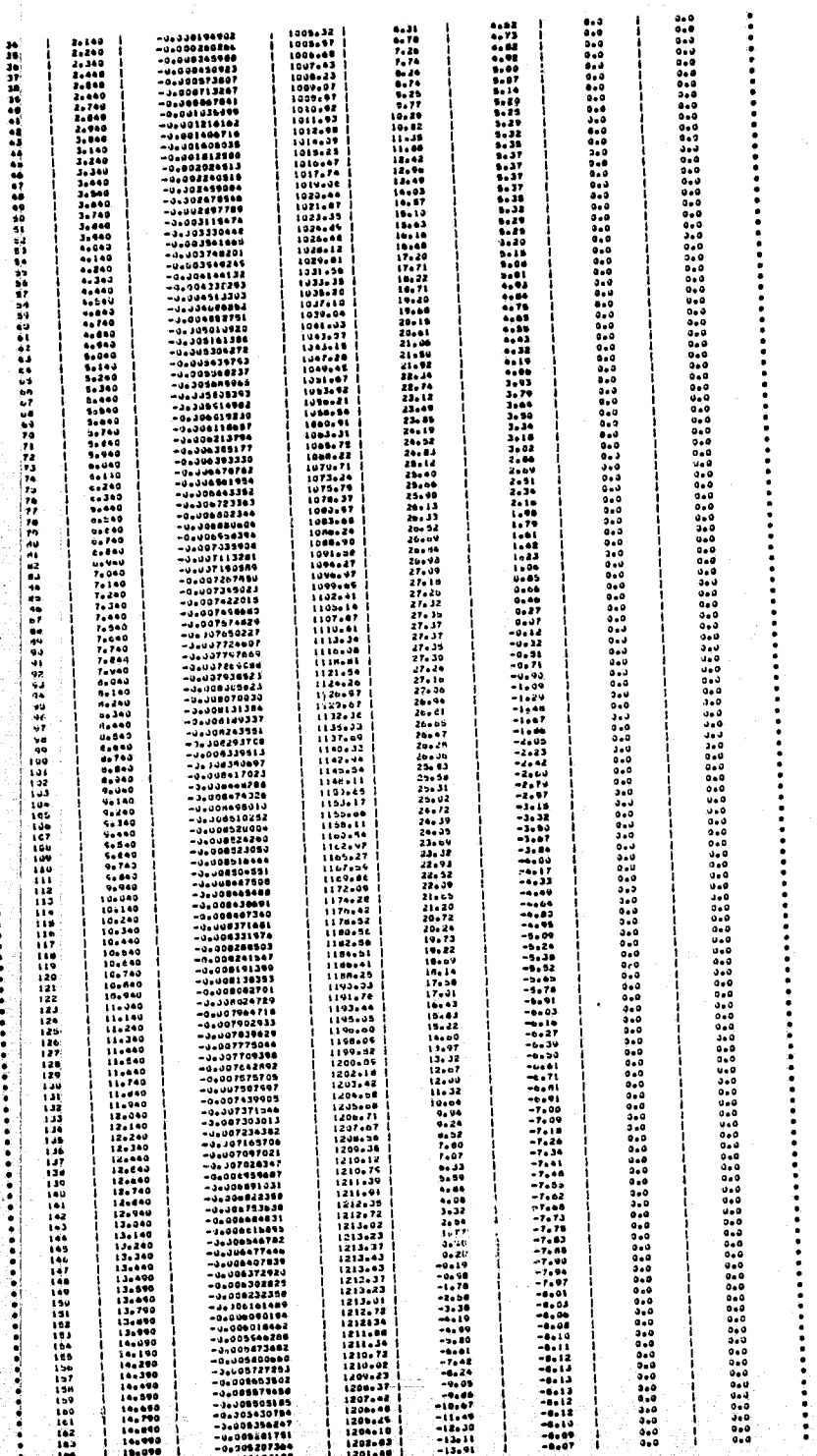
DATA POINT	TIME (SECS)	DENSITY (SLUG/FT**3)	ANGLE OF ATTACK (RADIANS)	TEMPERATURE (DEG-R)	ACCELERATION (FT/SEC**2)
248	23.400	3998.0315	-0.1333278	0.0111984	284.4897
249	23.500	3997.9811	-0.1321814	0.0117019	284.2783
250	23.600	3997.9467	-0.1309489	0.0121998	283.8681
251	23.700	3997.9378	-0.1297498	0.0126907	283.8178
252	23.800	3997.8334	-0.1284488	0.0131748	283.5788
253	23.900	3997.8898	-0.1271868	0.0136518	283.5328
254	24.000	3997.8248	-0.1258791	0.0141218	280.8144
255	24.100	3997.8208	-0.1227971	0.0145848	281.8429
256	24.200	3997.8187	-0.1212699	0.0150403	282.2815
257	24.300	3997.8113	-0.1198968	0.0154902	282.9725
258	24.400	3997.8069	-0.1184023	0.0159302	283.6763
259	24.500	3997.8025	-0.1169226	0.0163682	284.3671
260	24.600	3997.7981	-0.1147220	0.0167978	285.0809
261	24.700	3997.7938	-0.1129787	0.0172189	285.7886
262	24.800	3997.7892	-0.1111963	0.0176362	286.3810
263	24.900	3997.7848	-0.1093193	0.0180448	287.0672
264	25.000	3997.7804	-0.1078866	0.0184389	287.6939
265	25.100	3997.7760	-0.1056087	0.0188278	288.3313
266	25.200	3997.7716	-0.1038584	0.0192078	288.9590
267	25.300	3997.7672	-0.1018762	0.0195822	289.5772
268	25.400	3997.7627	-0.0998610	0.0203813	290.1857
269	25.500	3997.7583	-0.0976072	0.0207127	290.7845
270	25.600	3997.7539	-0.0958177	0.0210875	291.3736
271	25.700	3997.7495	-0.0933930	0.0214157	291.9529
272	25.800	3997.7451	-0.0912230	0.0217572	292.5216
273	25.900	3997.7407	-0.0890409	0.0220921	293.0887
274	26.000	3997.7363	-0.0868168	0.0224205	293.6298
275	26.100	3997.7319	-0.0845582	0.0227424	294.1668
276	26.200	3997.7275	-0.0822657	0.0230578	294.6976
277	26.300	3997.7231	-0.0799388	0.0233667	295.2162
278	26.400	3997.7187	-0.0775758	0.0236692	295.7265
279	26.500	3997.7142	-0.0752097	0.0239652	296.2226
280	26.600	3997.7098	-0.0727682	0.0242548	296.7103
281	26.700	3997.7054	-0.0703182	0.0245381	297.1876
282	26.800	3997.7010	-0.0678901	0.0248149	297.6545
283	26.900	3997.6966	-0.0654947	0.0250854	298.1110
284	27.000	3997.6922	-0.0626726	0.0253496	298.5569
285	27.100	3997.6878	-0.0603284	0.0256076	298.9928
286	27.200	3997.6834	-0.0577507	0.0258595	299.4173
287	27.300	3997.6790	-0.0551322	0.0261041	299.8316
288	27.400	3997.6747	-0.0525259	0.0263536	300.2353
289	27.500	3997.6703	-0.0498833	0.0265856	300.6284
290	27.600	3997.6659	-0.0472141	0.0268119	301.0109
291	27.700	3997.6615	-0.0445226	0.0270320	301.3827
292	27.800	3997.6571	-0.0418304	0.0272388	301.7439
293	27.900	3997.6527	-0.0390751	0.0274436	302.0963
294	28.000	3997.6483	-0.0363204	0.0276448	302.4341
295	28.100	3997.6439	-0.0335459	0.0278400	302.7631
296	28.200	3997.6395	-0.0307922	0.0280289	303.0815
297	28.300	3997.6351	-0.0279349	0.0282118	303.3891
298	28.400				



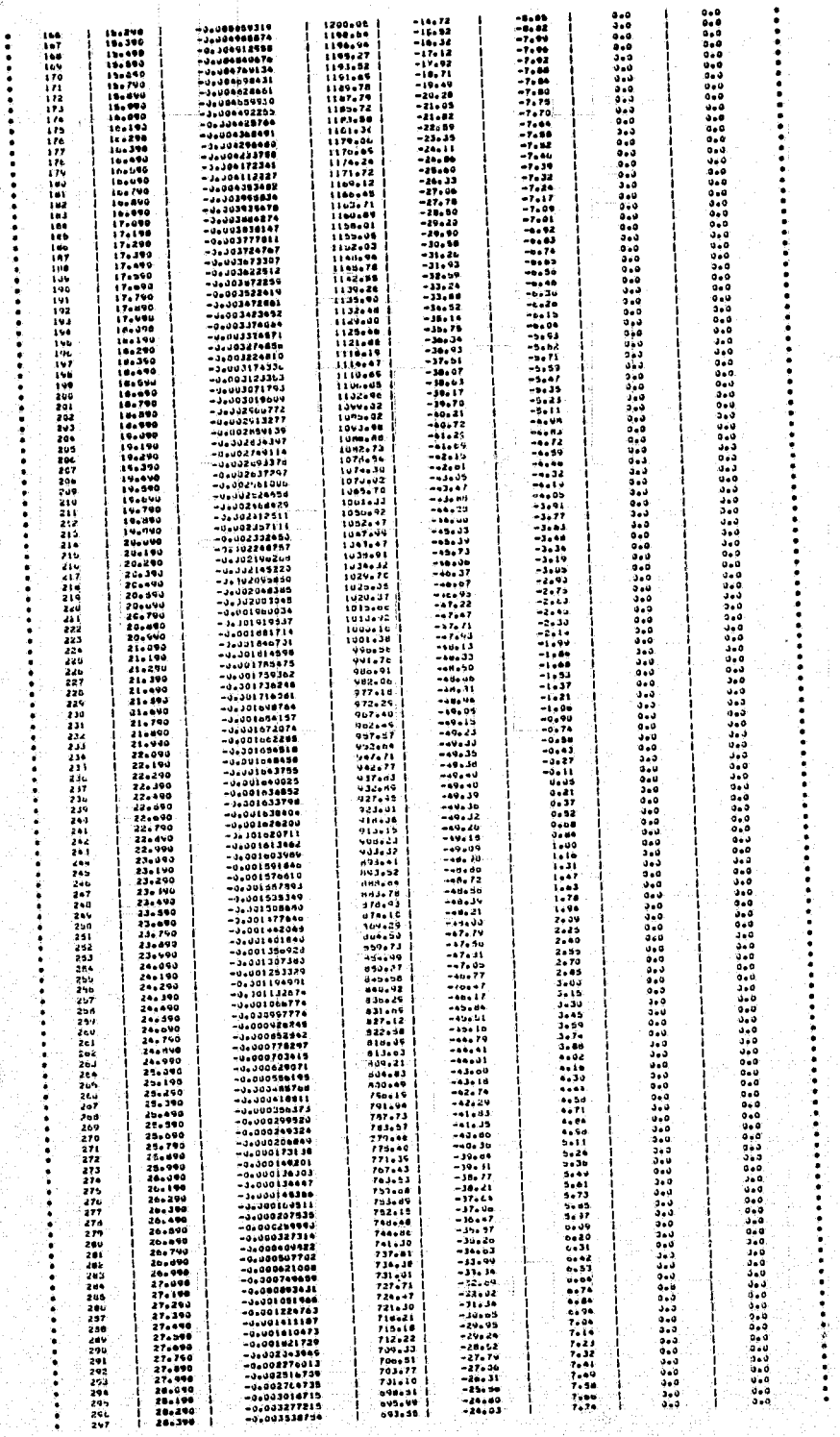
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207	19.200	0.00230444	0.0034982	520.00	0.78086	
208	19.400	0.00230472	0.0034328	520.00	0.71884	
209	19.600	0.00230502	0.0033727	520.00	0.78082	
210	19.800	0.00230532	0.0033176	520.00	0.84926	
211	19.790	0.00230561	0.0032668	520.00	0.80769	
212	19.980	0.00230591	0.0032198	520.00	0.87388	
213	19.980	0.00230621	0.0031772	520.00	0.85776	
214	20.000	0.00230652	0.0031387	520.00	0.82862	
215	20.190	0.00230682	0.0031042	520.00	0.81801	
216	20.200	0.00230713	0.0030738	520.00	0.85622	
217	20.200	0.00230745	0.0030473	520.00	0.87139	
218	20.000	0.00230776	0.0030249	520.00	0.84464	
219	20.000	0.00230808	0.0030068	520.00	0.81801	
220	20.000	0.00230839	0.0029928	520.00	0.80837	
221	20.790	0.00230871	0.0029796	520.00	0.80120	
222	20.000	0.00230904	0.0029720	520.00	0.81868	
223	21.000	0.00230936	0.0029680	520.00	0.83999	
224	21.000	0.00230968	0.0029677	520.00	0.83999	
225	21.190	0.00231001	0.0029709	520.00	0.83999	
226	21.290	0.00231036	0.0029776	520.00	0.82615	
227	21.200	0.00231067	0.0029877	520.00	0.82165	
228	21.690	0.00231100	0.0030012	520.00	0.81903	
229	21.990	0.00231133	0.0030181	520.00	0.81860	
230	21.990	0.00231166	0.0030382	520.00	0.80850	
231	21.790	0.00231199	0.0030616	520.00	0.81867	
232	21.890	0.00231232	0.0030882	520.00	0.80112	
233	21.990	0.00231266	0.0031184	520.00	0.80588	
234	22.090	0.00231300	0.0031519	520.00	0.80980	
235	22.190	0.00231333	0.0031886	520.00	0.79869	
236	22.290	0.00231367	0.0032287	520.00	0.78039	
237	22.290	0.00231401	0.0032719	520.00	0.80872	
238	22.690	0.00231436	0.0033183	520.00	0.80851	
239	22.490	0.00231469	0.0033678	520.00	0.80880	
240	22.690	0.00231501	0.0034205	520.00	0.81888	
241	22.790	0.00231536	0.0034764	520.00	0.82789	
242	22.890	0.00231569	0.0035355	520.00	0.83789	
243	22.990	0.00231602	0.0035978	520.00	0.82743	
244	23.090	0.00231636	0.0036634	520.00	0.81555	
245	23.190	0.00231669	0.0037321	520.00	0.80588	
246	23.290	0.00231702	0.0038041	520.00	0.79869	
247	23.390	0.00231736	0.0038792	520.00	0.79819	
248	23.490	0.00231769	0.0039575	520.00	0.80880	
249	23.590	0.00231802	0.0040389	520.00	0.81888	
250	23.690	0.00231835	0.0041235	520.00	0.82789	
251	23.790	0.00231867	0.0042113	520.00	0.83789	
252	23.890	0.00231900	0.0043022	520.00	0.82743	
253	23.990	0.00231933	0.0043962	520.00	0.81555	
254	24.090	0.00231965	0.0044934	520.00	0.80588	
255	24.190	0.00231997	0.0045936	520.00	0.79869	
256	24.290	0.00232029	0.0046967	520.00	0.79819	
257	24.390	0.00232061	0.0048027	520.00	0.80218	
258	24.490	0.00232093	0.0049115	520.00	0.81316	
259	24.590	0.00232126	0.0050230	520.00	0.80226	
260	24.690	0.00232158	0.0051373	520.00	0.79263	
261	24.790	0.00232189	0.0052543	520.00	0.78073	
262	24.890	0.00232217	0.0053631	520.00	0.80817	
263	24.990	0.00232267	0.0054908	520.00	0.81479	
264	25.090	0.00232277	0.0056080	520.00	0.82061	
265	25.190	0.00232307	0.0057275	520.00	0.82565	
266	25.290	0.00232337	0.0058492	520.00	0.82984	
267	25.390	0.00232366	0.0059408	520.00	0.83351	
268	25.490	0.00232398	0.0060586	520.00	0.83639	
269	25.590	0.00232426	0.0061780	520.00	0.81858	
270	25.690	0.00232452	0.0062995	520.00	0.84013	
271	25.790	0.00232480	0.0064230	520.00	0.76105	
272	25.890	0.00232508	0.0065486	520.00	0.64137	
273	25.990	0.00232536	0.0066758	520.00	0.50112	
274	26.090	0.00232563	0.0068046	520.00	0.64031	
275	26.190	0.00232589	0.0069353	520.00	0.33897	
276	26.290	0.00232618	0.0070682	520.00	0.23715	
277	26.390	0.00232641	0.0072028	520.00	0.13681	
278	26.490	0.00232667	0.0073391	520.00	0.23204	
279	26.590	0.00232692	0.0074770	520.00	0.92883	
280	26.690	0.00232717	0.0076163	520.00	0.82928	
281	26.790	0.00232741	0.0077570	520.00	0.72128	
282	26.890	0.00232765	0.0078990	520.00	0.61882	
283	26.990	0.00232788	0.0080422	520.00	0.51211	
284	27.090	0.00232812	0.0081867	520.00	0.40708	
285	27.190	0.00232834	0.0083324	520.00	0.30175	
286	27.290	0.00232856	0.0084793	520.00	0.19614	
287	27.390	0.00232878	0.0086273	520.00	0.09029	
288	27.490	0.00232899	0.0087764	520.00	0.98421	
289	27.590	0.00232920	0.0089266	520.00	0.87791	
290	27.690	0.00232940	0.0090779	520.00	0.77144	
291	27.790	0.00232960	0.0092302	520.00	0.66480	
292	27.890	0.00232979	0.0093834	520.00	0.55802	
293	27.990	0.00232998	0.0095376	520.00	0.45112	
294	28.090	0.00233016	0.0096927	520.00	0.34412	
295	28.190	0.00233034	0.0098487	520.00	0.23704	
296	28.290	0.00233051	0.0100056	520.00	0.12991	
297	28.390	0.00233068	0.0101633	520.00	0.02274	
298	28.490	0.00233084	0.0103219	520.00	0.91552	

DATA POINT	TIME (SECS)	ANGLE-OF-ATTACK RATE (RADIANS/SEC)	ALTITUDE (FT)	ALTITUDE RATE (FT/SEC)	ALT. ACCEL. (FT/SEC**2)	VERT. ACCEL. (FT/SEC**2)	ELEV. DEFLECT. (RADIANS)
1	0.0	-0.0003801821	1000.00	0.01	0.88	0.0	0.0
2	0.010	-0.0003779723	1000.00	0.02	0.01	0.0	0.0
3	0.020	-0.0003756626	1000.00	0.03	0.93	0.0	0.0
4	0.030	-0.0003732536	1000.00	0.04	0.96	0.0	0.0
5	0.040	-0.0003677455	1000.00	0.04	0.98	0.0	0.0
6	0.080	-0.0003615418	1000.00	0.06	1.02	0.0	0.0
7	0.080	-0.0003553238	1000.00	0.09	1.09	0.0	0.0
8	0.100	-0.0003491232	1000.01	0.11	1.15	0.0	0.0
9	0.120	-0.0003429318	1000.01	0.13	1.15	0.0	0.0
10	0.140	-0.0003367817	1000.01	0.15	1.19	0.0	0.0
11	0.160	-0.0003244322	1000.02	0.20	1.28	0.0	0.0
12	0.220	-0.0003121796	1000.03	0.28	1.36	0.0	0.0
13	0.260	-0.0003000078	1000.04	0.31	1.45	0.0	0.0
14	0.300	-0.0002878321	1000.05	0.37	1.53	0.0	0.0
15	0.340	-0.0002759044	1000.07	0.43	1.61	0.0	0.0
16	0.420	-0.0002524218	1000.11	0.57	1.78	0.0	0.0
17	0.500	-0.0002298644	1000.16	0.72	1.94	0.0	0.0
18	0.580	-0.0002078218	1000.22	0.88	2.11	0.0	0.0
19	0.660	-0.0001858581	1000.30	1.06	2.27	0.0	0.0
20	0.740	-0.0001638648	1000.39	1.24	2.42	0.0	0.0
21	0.820	-0.0001417147	1000.53	1.50	2.62	0.0	0.0
22	0.900	-0.0001197215	1000.69	1.77	2.80	0.0	0.0
23	1.040	-0.0000901535	1000.98	2.06	2.99	0.0	0.0
24	1.140	-0.0000704013	1001.18	2.38	3.17	0.0	0.0
25	1.240	-0.0000531768	1001.36	2.59	3.36	0.0	0.0
26	1.340	-0.0000389720	1001.64	2.80	3.51	0.0	0.0
27	1.440	-0.0000297863	1001.98	2.99	3.67	0.0	0.0
28	1.540	-0.0000276067	1002.32	3.76	3.82	0.0	0.0
29	1.640	-0.0000268971	1002.72	4.15	3.97	0.0	0.0
30	1.740	-0.0000256666	1003.18	4.58	4.12	0.0	0.0
31	1.840	-0.0000238208	1003.63	4.88	4.25	0.0	0.0
32	1.940	-0.0000214109	1004.18	5.41	4.38	0.0	0.0
33	2.040	-0.0000186999	1004.71	5.88	4.50	0.0	0.0



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290	26.490	-3.003801821	691.18	-23.28	7.81	0.0	0.0

NORMAL-TO-FLIGHT-PATH SOLUTION

MODEL 12 P0 = 6.3823289643531020D 03 CLA0= -1.0951800513883580D-03
P1 = 0.0 CLA = 6.3654654656999500D 00
P2 = 1.3795989938316530D 03 CLAX= -3.5488586679171570D-01
P3 = -2.4949221689430760D 00
P4 = 0.0

FIT ERROR: 7.8756343636517790D 03

F L I G H T   P A T H   T R A J E C T O R Y   P R E D I C T I O N

ITERATION # 1

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.000000D 03	1.467350D 02	8.143620D-08	1.626520D-01	1.024260D 00	1.066770D-01	4.000000D 03	1.473290D 05	4.664640D 00
1.000000D-02	1.000000D 03	1.467860D 02	1.125230D-04	1.626710D-01	1.024380D 00	1.067110D-01	4.000000D 03	1.473520D 05	4.658280D 00
2.000000D-02	1.000000D 03	1.468320D 02	1.750360D-04	1.626780D-01	1.024430D 00	1.067240D-01	4.000000D 03	1.473750D 05	4.652470D 00
3.000000D-02	1.000000D 03	1.468750D 02	2.389880D-04	1.626850D-01	1.024470D 00	1.067360D-01	4.000000D 03	1.473970D 05	4.646630D 00
4.000000D-02	1.000000D 03	1.469250D 02	3.043690D-04	1.626920D-01	1.024510D 00	1.067480D-01	4.000000D 03	1.474200D 05	4.640740D 00
6.000000D-02	1.000000D 03	1.470180D 02	4.364140D-04	1.627060D-01	1.024600D 00	1.067730D-01	4.000000D 03	1.474650D 05	4.628840D 00
8.000000D-02	1.000000D 03	1.471100D 02	5.801540D-04	1.627190D-01	1.024680D 00	1.067970D-01	4.000000D 03	1.475100D 05	4.616790D 00
1.000000D-01	1.000010D 03	1.472020D 02	7.265600D-04	1.627320D-01	1.024760D 00	1.068210D-01	4.000000D 03	1.475550D 05	4.604580D 00
1.200000D-01	1.000010D 03	1.472940D 02	8.786300D-04	1.627460D-01	1.024850D 00	1.068440D-01	4.000000D 03	1.476000D 05	4.592210D 00
1.400000D-01	1.000010D 03	1.473860D 02	1.036320D-03	1.627580D-01	1.024930D 00	1.068670D-01	3.999980D 03	1.476450D 05	4.579680D 00
1.800000D-01	1.000020D 03	1.475680D 02	1.368510D-03	1.627830D-01	1.025080D 00	1.069130D-01	3.999990D 03	1.477340D 05	4.554160D 00
2.200000D-01	1.000030D 03	1.477510D 02	1.772960D-03	1.628080D-01	1.025240D 00	1.069570D-01	3.999990D 03	1.478220D 05	4.528030D 00
2.600000D-01	1.000040D 03	1.479310D 02	2.099480D-03	1.628320D-01	1.025390D 00	1.070000D-01	3.999990D 03	1.479090D 05	4.501290D 00
3.000000D-01	1.000050D 03	1.481110D 02	2.497900D-03	1.628550D-01	1.025530D 00	1.070410D-01	3.999990D 03	1.479960D 05	4.473960D 00
3.400000D-01	1.000070D 03	1.482890D 02	2.918020D-03	1.628770D-01	1.025670D 00	1.070820D-01	3.999990D 03	1.480820D 05	4.446040D 00
4.200000D-01	1.000110D 03	1.486420D 02	3.822610D-03	1.629190D-01	1.025940D 00	1.071580D-01	3.999980D 03	1.482520D 05	4.388490D 00
5.000000D-01	1.000160D 03	1.489910D 02	4.811710D-03	1.629580D-01	1.026180D 00	1.072280D-01	3.999980D 03	1.484200D 05	4.328710D 00
5.800000D-01	1.000220D 03	1.493350D 02	5.883710D-03	1.629940D-01	1.026430D 00	1.072920D-01	3.999980D 03	1.485840D 05	4.266780D 00
6.600000D-01	1.000300D 03	1.496740D 02	7.034550D-03	1.630260D-01	1.026600D 00	1.073500D-01	3.999970D 03	1.487460D 05	4.202780D 00
7.400000D-01	1.000390D 03	1.500073D 02	8.264760D-03	1.630540D-01	1.026780D 00	1.074010D-01	3.999970D 03	1.489050D 05	4.136790D 00
8.400000D-01	1.000530D 03	1.504170D 02	9.919970D-03	1.630860D-01	1.026960D 00	1.074550D-01	3.999970D 03	1.490990D 05	4.051630D 00
9.400000D-01	1.000690D 03	1.508180D 02	1.168830D-02	1.631070D-01	1.027110D 00	1.074980D-01	3.999960D 03	1.492880D 05	3.963680D 00
1.040000D 00	1.000880D 03	1.512090D 02	1.357110D-02	1.631240D-01	1.027210D 00	1.075280D-01	3.999960D 03	1.494720D 05	3.873020D 00
1.140000D 00	1.001100D 03	1.515920D 02	1.556470D-02	1.631330D-01	1.027270D 00	1.075480D-01	3.999960D 03	1.496520D 05	3.779890D 00
1.240000D 00	1.001350D 03	1.519650D 02	1.766540D-02	1.631360D-01	1.027290D 00	1.075490D-01	3.999950D 03	1.498260D 05	3.684460D 00
1.340000D 00	1.001640D 03	1.523290D 02	1.986930D-02	1.631300D-01	1.027250D 00	1.075360D-01	3.999950D 03	1.499960D 05	3.586880D 00
1.440000D 00	1.001960D 03	1.526830D 02	2.217230D-02	1.631160D-01	1.027160D 00	1.075140D-01	3.999950D 03	1.501600D 05	3.487350D 00
1.540000D 00	1.002320D 03	1.530260D 02	2.457050D-02	1.630930D-01	1.027020D 00	1.074730D-01	3.999940D 03	1.503190D 05	3.386040D 00
1.640000D 00	1.002710D 03	1.533600D 02	2.735960D-02	1.630620D-01	1.026820D 00	1.074150D-01	3.999940D 03	1.504720D 05	3.283140D 00
1.740000D 00	1.003130D 03	1.536830D 02	2.963560D-02	1.630200D-01	1.026560D 00	1.073400D-01	3.999930D 03	1.506210D 05	3.178840D 00
1.840000D 00	1.003620D 03	1.539960D 02	3.229350D-02	1.629680D-01	1.026240D 00	1.072460D-01	3.999930D 03	1.507640D 05	3.073310D 00
1.940000D 00	1.004140D 03	1.542980D 02	3.502960D-02	1.629060D-01	1.025850D 00	1.071340D-01	3.999930D 03	1.509020D 05	2.966750D 00
2.040000D 00	1.004700D 03	1.545890D 02	3.783910D-02	1.628330D-01	1.025390D 00	1.070020D-01	3.999920D 03	1.510350D 05	2.859340D 00
2.140000D 00	1.005310D 03	1.548690D 02	4.071760D-02	1.627490D-01	1.024870D 00	1.068500D-01	3.999920D 03	1.511620D 05	2.751250D 00
2.240000D 00	1.005970D 03	1.551390D 02	4.366030D-02	1.626530D-01	1.024270D 00	1.066780D-01	3.999920D 03	1.512850D 05	2.642660D 00
2.340000D 00	1.006670D 03	1.553980D 02	4.666280D-02	1.625460D-01	1.023590D 00	1.064860D-01	3.999910D 03	1.514020D 05	2.533730D 00
2.440000D 00	1.007420D 03	1.556460D 02	4.972030D-02	1.624250D-01	1.022850D 00	1.062710D-01	3.999910D 03	1.515130D 05	2.424640D 00
2.540000D 00	1.008210D 03	1.558830D 02	5.282820D-02	1.622930D-01	1.022020D 00	1.060360D-01	3.999900D 03	1.516200D 05	2.315580D 00
2.640000D 00	1.009060D 03	1.561090D 02	5.598190D-02	1.621490D-01	1.021120D 00	1.057800D-01	3.999900D 03	1.517210D 05	2.206610D 00
2.740000D 00	1.009960D 03	1.563240D 02	5.917650D-02	1.619920D-01	1.020140D 00	1.055030D-01	3.999900D 03	1.518180D 05	2.098000D 00
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2.649000 01	1.037910 03	2.984740 02	-1.415380-01	5.514840-02	3.477110-01	3.901930-02	3.998930 03	1.742520 05	5.237130 00
2.659000 01	1.039410 03	2.994740 02	-1.397150-01	5.508630-02	3.473170-01	3.901000-02	3.998920 03	1.742160 05	5.134810 00
2.669000 01	1.040910 03	3.004740 02	-1.378920-01	5.502583-02	3.469340-01	3.900090-02	3.998920 03	1.741800 05	5.032040 00
2.679000 01	1.042410 03	3.014740 02	-1.360710-01	5.496710-02	3.465620-01	3.899210-02	3.998910 03	1.741430 05	4.928830 00
2.689000 01	1.043910 03	3.024740 02	-1.342540-01	5.491000-02	3.462000-01	3.898350-02	3.998910 03	1.741060 05	4.825200 00
2.709000 01	1.046910 03	3.044740 02	-1.306230-01	5.485480-02	3.458490-01	3.897530-02	3.998900 03	1.740310 05	4.616820 00
2.719000 01	1.048410 03	3.054740 02	-1.288100-01	5.480080-02	3.455080-01	3.896720-02	3.998900 03	1.739930 05	4.512110 00
2.729000 01	1.049910 03	3.064740 02	-1.270000-01	5.474860-02	3.451770-01	3.895940-02	3.998890 03	1.739550 05	4.407080 00
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2.759000 01	1.054410 03	3.094740 02	-1.216080-01	5.460340-02	3.442450-01	3.893770-02	3.998880 03	1.738440 05	4.090290 00
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2.779000 01	1.057410 03	3.114740 02	-1.180540-01	5.451610-02	3.436710-01	3.892410-02	3.998870 03	1.737700 05	3.877910 00
2.789000 01	1.058910 03	3.124740 02	-1.162930-01	5.447550-02	3.433990-01	3.891770-02	3.998870 03	1.737330 05	3.771440 00
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2.809000 01	1.061910 03	3.144740 02	-1.128090-01	5.440030-02	3.428810-01	3.890580-02	3.998860 03	1.736620 05	3.558020 00
2.819000 01	1.063410 03	3.154740 02	-1.110870-01	5.436570-02	3.426360-01	3.889990-02	3.998850 03	1.736270 05	3.451120 00
2.829000 01	1.064910 03	3.164740 02	-1.093800-01	5.433310-02	3.424000-01	3.889440-02	3.998850 03	1.735930 05	3.344120 00
2.839000 01	1.066410 03	3.174740 02	-1.076900-01	5.430240-02	3.421720-01	3.888910-02	3.998840 03	1.735590 05	3.237060 00
2.849000 01	1.067910 03	3.184740 02	-1.060180-01	5.427360-02	3.419530-01	3.888430-02	3.998840 03	1.735260 05	3.129910 00
2.859000 01	1.069410 03	3.194740 02	-1.043660-01	5.424680-02	3.417420-01	3.887910-02	3.998840 03	1.734930 05	3.022740 00

COST FUNCTION (J) = 2.107863C1370580000 05

WITH:

ALTITUDE TOLERANCE = 3.6U702056544890-03

FLIGHT-PATH-ANGLE TOLERANCE = 0.4539916249659U0-09

FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE = 0.6733968863979D-10

WEIGHT TOLERANCE = 0.0

ENERGY TOLERANCE = 0.807178273613B0-03

ANGLE-OF-ATTACK TOLERANCE = 0.0

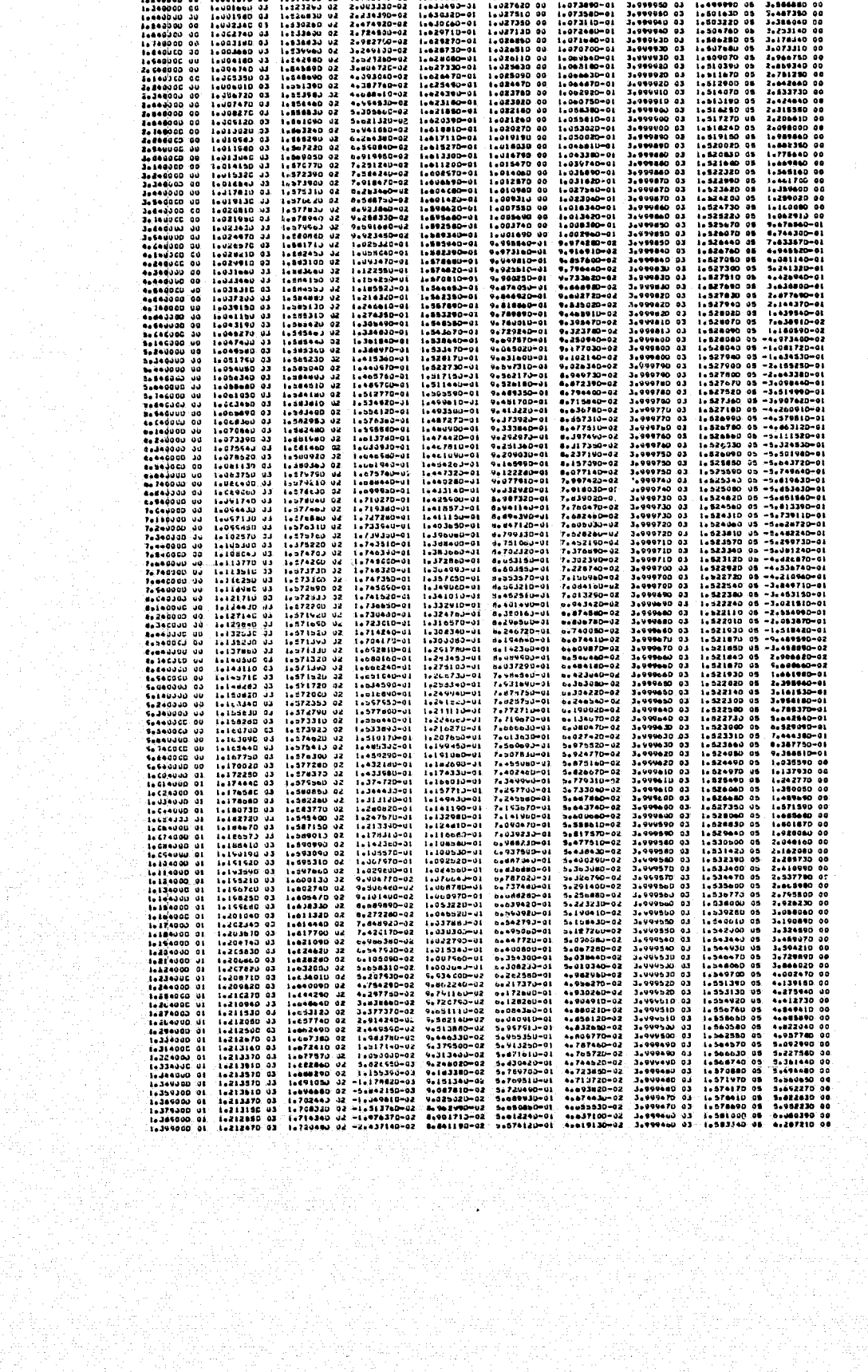
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0.2863324263090 05	+ 1.00* 0.102112360 03	= 0.2873513632585D 05	
0.0	+ 1.00* 0.0	= 0.0	(FROZEN)
0.1128595936290 04	+ 1.00* 0.1195376980 01	= 0.1132664216446D 04	
-0.2178720747853D 01	+ 1.00* 0.0000007602-02	= -0.2178719614U310 01	
0.0	+ 1.00* 0.0	= 0.0	(FROZEN)
0.3498441186275D-01	+ 1.00* 0.8833746704-04	= 0.3507274287360-01	
0.0	+ 1.00* 0.0	= 0.0	(FROZEN)
0.1308158273390 01	+ 1.00* 0.8552433B0-02	= 0.1299605835980 01	
0.0	+ 1.00* 0.0	= 0.0	(FROZEN)
0.2U027C2263233D 04	+ 1.00* 0.7230665320 01	= 0.2009992916260 04	
-0.2891G8B642386D-02	+ 1.00* 0.331271173D-02	= 0.4210206774760-03	
0.0	+ 1.00* 0.0	= 0.0	(FROZEN)
0.3776591249270 01	+ 1.00* 0.7690131010-01	= 0.2299956147930 01	
-0.4305063497B570 00	+ 1.00* 0.443U530790 00	= -0.3270366991213D-04	

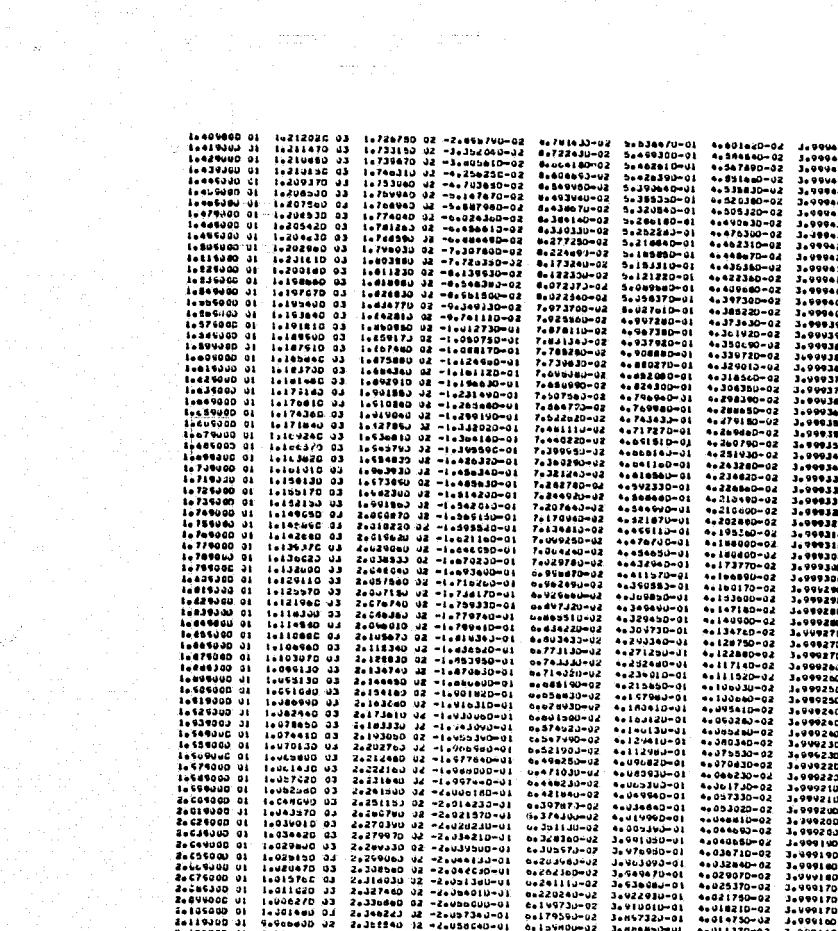
FLIGHT PATH TRAJECTORY PROJECTION

ITERATION # 2

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.000000E 03	1.407390 02	5.163420-05	1.026540-01	1.025130 00	1.066760-01	4.000000 03	1.473290 05	4.468040 00
2.000000E-02	1.000000 03	1.407880 02	1.162560-04	1.026720-01	1.025250 00	1.067090-01	4.000000 03	1.473520 05	4.468280 00
4.000000E-02	1.000000E 03	1.408320 02	1.786920-04	1.026780-01	1.025290 00	1.067200-01	4.000000 03	1.473740 05	4.468470 00
6.000000E-02	1.000000 03	1.408760 02	2.444690-04	1.026840-01	1.025330 00	1.067300-01	4.000000 03	1.473960 05	4.468660 00
8.000000E-02	1.000000 03	1.409200 02	3.119280-04	1.026900-01	1.025360 00	1.067410-01	4.000000 03	1.473970 05	4.468630 00
0.100000E-01	1.000000 03	1.409640 02	4.802250-04	1.026960-01	1.025400 00	1.067520-01	4.000000 03	1.474200 05	4.468740 00
0.120000E-01	1.000000 03	1.410080 02	5.494750-04	1.027020-01	1.025440 00	1.067620-01	4.000000 03	1.474650 05	4.468840 00
1.400000E-01	1.000001E 03	1.472020 02	7.483400-04	1.027240-01	1.025580 00	1.067820-01	4.000000 03	1.475130 05	4.416790 00
1.600000E-01	1.000003 03	1.472960 02	8.998140-04	1.027360-01	1.025660 00	1.068030-01	4.000000 03	1.475550 05	4.604580 00
1.800000E-01	1.000010 03	1.473880 02	1.060870-03	1.027670-01	1.025720 00	1.068430-01	4.000000 03	1.476000 05	4.392210 00
2.000000E-01	1.000020E 03	1.474790 02	1.219660-03	1.027680-01	1.025850 00	1.068820-01	3.999990 03	1.476450 05	4.579680 00
2.200000E-01	1.000030 03	1.475710 02	1.378020-03	1.027890-01	1.025990 00	1.069200-01	3.999990 03	1.477340 05	4.584160 00
2.600000E-01	1.000060 03	1.479310 02	2.163280-03	1.028000-01	1.026120 00	1.069570-01	3.999990 03	1.478220 05	4.528030 00
3.000000E-01	1.000100 03	1.481110 02	2.947780-03	1.028300-01	1.026240 00	1.069920-01	3.999990 03	1.479100 05	4.501290 00
3.400000E-01	1.000150 03	1.482890 02	3.973820-03	1.028690-01	1.026360 00	1.070270-01	3.999990 03	1.479960 05	4.473960 00
4.200000E-01	1.000310 03	1.486420 02	5.484830-03	1.029850-01	1.026590 00	1.070930-01	3.999990 03	1.481630 05	4.446040 00
5.000000E-01	1.000510 03	1.489910 02	6.885710-03	1.029190-01	1.026800 00	1.071530-01	3.999980 03	1.482530 05	4.388490 00
5.800000E-01	1.000230 03	1.493350 02	8.971970-03	1.029490-01	1.026990 00	1.072080-01	3.999980 03	1.484210 05	4.328710 00
6.600000E-01	1.001310 03	1.496760 02	7.136970-03	1.029760-01	1.027160 00	1.072570-01	3.999970 03	1.485860 05	4.266780 00
7.400000E-01	1.000490 03	1.500070 02	8.377050-03	1.030000-01	1.027310 00	1.072990-01	3.999970 03	1.486760 05	4.202760 00
8.400000E-01	1.000540 03	1.504173 02	1.003820-02	1.030240-01	1.027460 00	1.073460-01	3.999970 03	1.491010 05	4.051830 00

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 2.849880D 01  6.913020D 02  2.838890D 02 -8.211780D-02  3.401780D-02  3.417430D-01  3.893830D-02  3.998880D 03  1.737290D 05  3.022740D 00
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COST FUNCTION (J) =  8.338016871028826000-02
WITH:
      ALTITUDE TOLERANCE =  3.136036051863636D-01
      FLIGHT-PATH-ANGLE TOLERANCE =  9.681725313288950-06
      FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE =  8.162936465312180-06
      HEIGHT TOLERANCE =  0.0
      ENERGY TOLERANCE =  8.138402221529600-01
      ANGLE-OF-ATTACK TOLERANCE =  0.0
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PREVIOUS COEFFICIENT          I.000*DELTA          NEW COEFFICIENT

 0.2873814631000 05 + 1.000* 0.5105351200-02 =  0.2873814631000 05  (FROZEN)
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.1121664236666963 04 + 1.000*-0.4776447500-04 =  0.1121664236666963 04  (FROZEN)
-0.2171016371209300 01 + 1.000* 0.4262161930-06 = -0.2171016371209300 01  (FROZEN)
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.3509020228611100 01 + 1.000* 0.1765269740-06 =  0.3509020228611100 01
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.1289356711793130 01 + 1.000*-0.1400668030-02 =  0.1289356711793130 01
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.2020662731004800 04 + 1.000* 0.1888163960 02 =  0.2020662731004800 04
 0.2123027063311300-03 + 1.000*-0.2087223360-03 =  0.2123027063311300-03
 0.3434089617783500 01 + 1.000* 0.1110226430-05 =  0.3434089617783500 01
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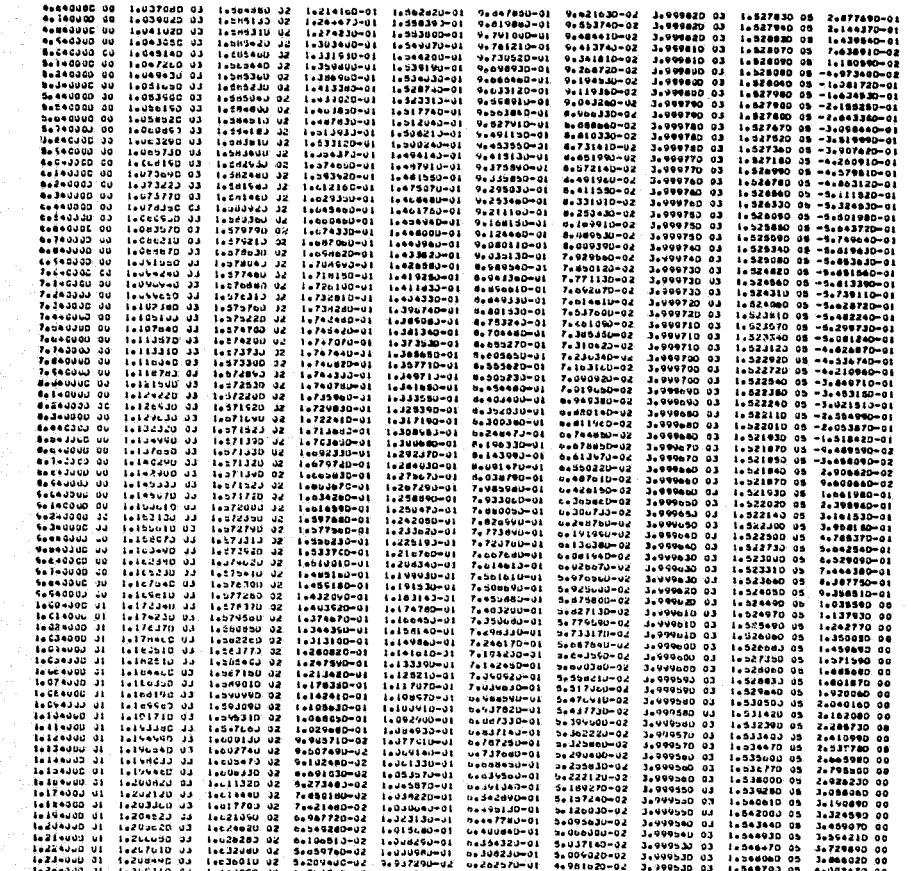
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PREVIOUS COEFFICIENT          I.000*DELTA          NEW COEFFICIENT

 0.2873814631000 05 + 1.000* 0.0          =  0.2873814631000 05  (FROZEN)
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.1121664236666963 04 + 1.000* 0.0          =  0.1121664236666963 04  (FROZEN)
-0.2171016371209300 01 + 1.000* 0.0          = -0.2171016371209300 01  (FROZEN)
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.3509020228611100 01 + 1.000* 0.1765269750-06 =  0.3509020228611100 01
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.1289356711793130 01 + 1.000*-0.1400668030-02 =  0.1289356711793130 01
 0.0          + 1.000* 0.0          =  0.0          (FROZEN)
 0.2020662731004800 04 + 1.000* 0.1888163960 02 =  0.2020662731004800 04
 0.2123027063311300-03 + 1.000*-0.2087223360-03 =  0.2123027063311300-03
 0.3434089617783500 01 + 1.000* 0.1110226430-05 =  0.3434089617783500 01
-0.8597643512970400-04 + 1.000* 0.2410746060-04 = -0.8597643512970400-04
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F L I G H T P A T H T R A J E C T O R Y P R E D I C T I O N

ITERATION # 3

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.000000 03	1.400000 02	0.0	1.625020-01	1.025360 00	1.060680-01	4.000000 03	1.473290 05	4.000000 00
2.000000-02	1.000000 03	1.400000 02	1.120630-04	1.625810-01	1.025470 00	1.060715D-01	4.000000 03	1.473520 05	4.000280 00
2.000000-02	1.000000 03	1.400000 02	1.752800-04	1.625880-01	1.025810 00	1.060727D-01	4.000000 03	1.473740 05	4.000427D 00
3.000000-02	1.000000 03	1.400000 02	2.630400-04	1.625980-01	1.026260 00	1.060739D-01	4.000000 03	1.474070 05	4.000640 00
4.000000-02	1.000000 03	1.400000 02	3.508200-04	1.626010-01	1.026690 00	1.060751D-01	4.000000 03	1.474200 05	4.000740 00
5.000000-02	1.000000 03	1.400000 02	4.385800-04	1.626150-01	1.026960 00	1.060776D-01	4.000000 03	1.474650 05	4.000840 00
6.000000-02	1.000000 03	1.400000 02	5.261100-04	1.626280-01	1.027260 00	1.060790D-01	4.000000 03	1.475100 05	4.000790 00
7.000000-02	1.000000 03	1.400000 02	6.135200-04	1.626410-01	1.027560 00	1.060820D-01	4.000000 03	1.475550 05	4.000580 00
8.000000-02	1.000000 03	1.400000 02	7.007800-04	1.626540-01	1.027830 00	1.060860D-01	4.000000 03	1.476000 05	4.000210 00
9.000000-02	1.000000 03	1.400000 02	7.878900-04	1.626670-01	1.028010 00	1.060890D-01	3.999990 03	1.476450 05	3.999680 00
1.000000-01	1.000000 03	1.400000 02	8.748300-04	1.626790-01	1.028180 00	1.060918D-01	3.999990 03	1.476900 05	3.999000 00
1.100000-01	1.000000 03	1.400000 02	9.616000-04	1.626920-01	1.028360 00	1.060948D-01	3.999990 03	1.477350 05	3.998160 00
1.200000-01	1.000000 03	1.400000 02	1.048200-03	1.627050-01	1.028540 00	1.060978D-01	3.999990 03	1.477800 05	3.997080 00
1.300000-01	1.000000 03	1.400000 02	1.134600-03	1.627180-01	1.028720 00	1.061008D-01	3.999990 03	1.478250 05	3.995760 00
1.400000-01	1.000000 03	1.400000 02	1.220800-03	1.627310-01	1.028900 00	1.061038D-01	3.999990 03	1.478700 05	3.994200 00
1.500000-01	1.000000 03	1.400000 02	1.306800-03	1.627440-01	1.029080 00	1.061068D-01	3.999990 03	1.479150 05	3.992400 00
1.600000-01	1.000000 03	1.400000 02	1.392600-03	1.627570-01	1.029260 00	1.061098D-01	3.999990 03	1.479600 05	3.990360 00
1.700000-01	1.000000 03	1.400000 02	1.478200-03	1.627700-01	1.029440 00	1.061128D-01	3.999990 03	1.480050 05	3.988080 00
1.800000-01	1.000000 03	1.400000 02	1.563600-03	1.627830-01	1.029620 00	1.061158D-01	3.999990 03	1.480500 05	3.985560 00
1.900000-01	1.000000 03	1.400000 02	1.648800-03	1.627960-01	1.029800 00	1.061188D-01	3.999990 03	1.480950 05	3.982800 00
2.000000-01	1.000000 03	1.400000 02	1.733800-03	1.628090-01	1.029980 00	1.061218D-01	3.999990 03	1.481400 05	3.979800 00
2.100000-01	1.000000 03	1.400000 02	1.818600-03	1.628220-01	1.030160 00	1.061248D-01	3.999990 03	1.481850 05	3.976560 00
2.200000-01	1.000000 03	1.400000 02	1.903200-03	1.628350-01	1.030340 00	1.061278D-01	3.999990 03	1.482300 05	3.973080 00
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2.500000-01	1.000000 03	1.400000 02	2.155800-03	1.628740-01	1.030880 00	1.061368D-01	3.999990 03	1.483650 05	3.961200 00
2.600000-01	1.000000 03	1.400000 02	2.239600-03	1.628870-01	1.031060 00	1.061398D-01	3.999990 03	1.484100 05	3.956760 00
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ORIGINAL PAGE IS
OF POOR QUALITY



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FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE = 0.5JU3852544728&0-10
WEIGHT TOLERANCE = 0.0
ENERGY TOLERANCE = 0.52296710172952D-02
ANGLE-OF-ATTACK TOLERANCE = 0.0

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0.0	+ 1.00* 0.0		=	0.0	(FROZEN)
0.112e442060e980 06	+ 1.00* 0.0		=	0.112e442060e980 06	(FROZEN)
-0.217016371209JD 01	+ 1.00* 0.0		=	-0.217016371209JD 01	(FROZEN)
0.0	+ 1.00* 0.0		=	0.0	(FROZEN)

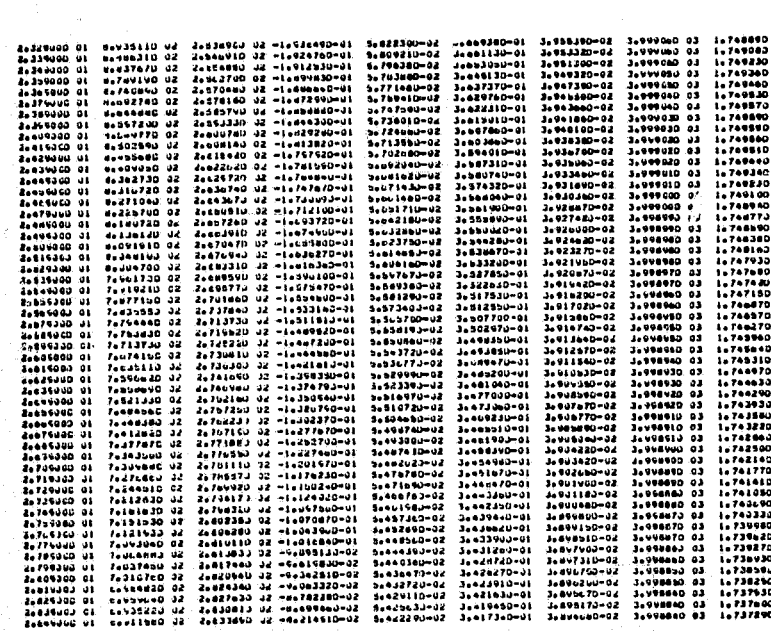
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0.35090823826281D-01 + 1.00* 0.16562998D-04 = 0.35186765260830D-01
0.0                  + 1.00* 0.0            = 0.0                    (FROZEN)
0.12913887178963D 01 + 1.00*-0.60822463D-02 = 0.12888149326650D 01
0.0                  + 1.00* 0.0            = 0.0                    (FROZEN)
0.20268273105980D 04 + 1.00* 0.63902451D 01 = 0.20322178867130D 04
0.21230270631310D-03 + 1.00*-0.13444774D-03 = 0.77856496870431D-04
0.62999572661600D 01 + 1.00* 0.10080000D-02 = 0.63009572661600D 01
-0.95496363812974D-05 + 1.00* 0.85054033D-05 = -0.90860200621700D-07
```

F L I G H T   P A T H   T R A J E C T O R Y   P R E D I C T I O N

ITERATION # 4

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.000000D 03	1.467390D 02	5.143620D-05	1.625720D-01	1.024430D 00	1.066790D-01	4.000000D 03	1.473290D 05	4.664040D 00
1.000000D-02	1.000000D 03	1.467880D 02	1.128630D-04	1.625910D-01	1.024560D 00	1.067140D-01	4.000000D 03	1.473520D 05	4.658280D 00
2.000000D-02	1.000000D 03	1.468320D 02	1.756730D-04	1.625970D-01	1.024660D 00	1.067260D-01	4.000000D 03	1.473740D 05	4.652470D 00
3.000000D-02	1.000000D 03	1.468750D 02	2.399330D-04	1.626040D-01	1.024640D 00	1.067380D-01	4.000000D 03	1.473970D 05	4.646630D 00
4.000000D-02	1.000000D 03	1.469250D 02	3.058260D-04	1.626110D-01	1.024680D 00	1.067500D-01	4.000000D 03	1.474200D 05	4.640740D 00
6.000000D-02	1.000000D 03	1.470160D 02	4.412890D-04	1.626240D-01	1.024760D 00	1.067740D-01	4.000000D 03	1.474650D 05	4.628840D 00
8.000000D-02	1.000000D 03	1.471100D 02	5.826400D-04	1.626370D-01	1.024850D 00	1.067980D-01	4.000000D 03	1.475100D 05	4.616790D 00
1.000000D-01	1.000010D 03	1.472020D 02	7.290580D-04	1.626500D-01	1.024930D 00	1.068210D-01	4.000000D 03	1.475550D 05	4.604580D 00
1.200000D-01	1.000010D 03	1.472940D 02	8.823200D-04	1.626630D-01	1.025010D 00	1.068450D-01	4.000000D 03	1.476000D 05	4.592210D 00
1.400000D-01	1.000010D 03	1.473860D 02	1.040610D-03	1.626750D-01	1.025090D 00	1.068680D-01	3.999990D 03	1.476450D 05	4.579680D 00
1.800000D-01	1.000020D 03	1.475690D 02	1.373980D-03	1.627000D-01	1.025240D 00	1.069110D-01	3.999990D 03	1.477340D 05	4.554160D 00
2.200000D-01	1.000020D 03	1.477510D 02	1.729850D-03	1.627240D-01	1.025390D 00	1.069540D-01	3.999990D 03	1.478220D 05	4.528030D 00
2.600000D-01	1.000040D 03	1.479310D 02	2.107190D-03	1.627470D-01	1.025540D 00	1.069960D-01	3.999990D 03	1.479100D 05	4.501290D 00
3.000000D-01	1.000050D 03	1.481110D 02	2.506700D-03	1.627690D-01	1.025680D 00	1.070370D-01	3.999990D 03	1.479960D 05	4.473980D 00
3.400000D-01	1.000070D 03	1.482690D 02	2.927880D-03	1.627910D-01	1.025820D 00	1.070760D-01	3.999990D 03	1.480830D 05	4.446040D 00
4.200000D-01	1.000110D 03	1.486420D 02	3.634560D-03	1.628320D-01	1.026070D 00	1.071510D-01	3.999980D 03	1.482530D 05	4.388490D 00
5.000000D-01	1.000160D 03	1.489910D 02	4.825860D-03	1.628700D-01	1.026310D 00	1.072190D-01	3.999980D 03	1.484210D 05	4.328710D 00
5.800000D-01	1.000220D 03	1.493350D 02	5.899540D-03	1.629040D-01	1.026540D 00	1.072820D-01	3.999980D 03	1.485860D 05	4.266780D 00
6.600000D-01	1.000300D 03	1.496740D 02	7.054670D-03	1.629380D-01	1.026730D 00	1.073380D-01	3.999970D 03	1.487470D 05	4.202780D 00
7.400000D-01	1.000390D 03	1.500070D 02	8.289250D-03	1.629630D-01	1.026900D 00	1.073860D-01	3.999970D 03	1.489060D 05	4.136790D 00
8.400000D-01	1.000530D 03	1.504170D 02	9.941600D-03	1.629910D-01	1.027060D 00	1.074400D-01	3.999970D 03	1.491010D 05	4.051630D 00
9.400000D-01	1.000690D 03	1.508180D 02	1.171190D-02	1.630140D-01	1.027220D 00	1.074810D-01	3.999960D 03	1.492900D 05	3.963680D 00
1.040000D 00	1.000880D 03	1.512090D 02	1.359470D-02	1.630300D-01	1.027320D 00	1.075100D-01	3.999960D 03	1.494750D 05	3.873020D 00
1.140000D 00	1.001100D 03	1.515920D 02	1.559220D-02	1.630380D-01	1.027380D 00	1.075260D-01	3.999960D 03	1.496540D 05	3.779890D 00
1.240000D 00	1.001360D 03	1.519650D 02	1.769460D-02	1.630400D-01	1.027390D 00	1.075290D-01	3.999950D 03	1.498290D 05	3.684460D 00
1.340000D 00	1.001640D 03	1.523290D 02	1.990020D-02	1.630340D-01	1.027350D 00	1.075180D-01	3.999950D 03	1.499990D 05	3.586880D 00
1.440000D 00	1.001960D 03	1.526830D 02	2.220480D-02	1.630190D-01	1.027260D 00	1.074920D-01	3.999950D 03	1.501630D 05	3.487350D 00
1.540000D 00	1.002320D 03	1.530280D 02	2.460450D-02	1.629960D-01	1.027110D 00	1.074490D-01	3.999940D 03	1.503220D 05	3.386040D 00
1.640000D 00	1.002720D 03	1.533630D 02	2.709500D-02	1.629660D-01	1.026910D 00	1.073910D-01	3.999940D 03	1.504760D 05	3.283140D 00
1.740000D 00	1.003150D 03	1.536880D 02	2.967220D-02	1.629220D-01	1.026640D 00	1.073150D-01	3.999930D 03	1.506250D 05	3.178840D 00
1.840000D 00	1.003630D 03	1.539960D 02	3.233160D-02	1.628700D-01	1.026320D 00	1.072200D-01	3.999930D 03	1.507680D 05	3.073310D 00
1.940000D 00	1.004150D 03	1.542980D 02	3.506880D-02	1.628080D-01	1.025920D 00	1.071070D-01	3.999930D 03	1.509070D 05	2.966780D 00
2.040000D 00	1.004710D 03	1.545890D 02	3.787560D-02	1.627380D-01	1.025460D 00	1.069780D-01	3.999920D 03	1.510390D 05	2.859340D 00
2.140000D 00	1.005320D 03	1.548690D 02	4.075910D-02	1.626610D-01	1.024930D 00	1.068220D-01	3.999920D 03	1.511670D 05	2.751250D 00
2.240000D 00	1.005970D 03	1.551390D 02	4.370280D-02	1.625550D-01	1.024330D 00	1.066490D-01	3.999920D 03	1.512900D 05	2.642640D 00
2.340000D 00	1.006660D 03	1.553980D 02	4.670820D-02	1.624470D-01	1.023650D 00	1.064560D-01	3.999910D 03	1.514070D 05	2.533730D 00
2.440000D 00	1.007430D 03	1.556460D 02	4.976450D-02	1.623280D-01	1.022900D 00	1.062420D-01	3.999910D 03	1.515190D 05	2.424640D 00
2.540000D 00	1.008220D 03	1.558830D 02	5.287320D-02	1.621970D-01	1.022070D 00	1.060080D-01	3.999900D 03	1.516250D 05	2.315850D 00
2.640000D 00	1.009070D 03	1.561090D 02	5.602750D-02	1.620530D-01	1.021170D 00	1.057500D-01	3.999900D 03	1.517270D 05	2.206610D 00
2.740000D 00	1.009970D 03	1.563240D 02	5.922270D-02	1.618970D-01	1.020180D 00	1.054730D-01	3.999900D 03	1.518240D 05	2.098000D 00
2.840000D 00	1.010920D 03	1.565290D 02	6.245620D-02	1.617280D-01	1.019120D 00	1.051740D-01	3.999890D 03	1.519150D 05	1.989860D 00
2.940000D 00	1.011930D 03	1.567220D 02	6.571710D-02	1.615460D-01	1.017970D 00	1.048530D-01	3.999890D 03	1.520020D 05	1.882350D 00
3.040000D 00	1.012980D 03	1.569050D 02	6.900880D-02	1.613510D-01	1.016740D 00	1.045120D-01	3.999880D 03	1.520830D 05	1.775640D 00
3.140000D 00	1.014090D 03	1.570770D 02	7.231860D-02	1.611430D-01	1.015430D 00	1.041480D-01	3.999880D 03	1.521600D 05	1.669860D 00
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3.340000D 00	1.016470D 03	1.573900D 02	7.898930D-02	1.606850D-01	1.012590D 00	1.033560D-01	3.999870D 03	1.522990D 05	1.461700D 00
3.440000D 00	1.017740D 03	1.575310D 02	8.233890D-02	1.604360D-01	1.010980D 00	1.029280D-01	3.999870D 03	1.523620D 05	1.359600D 00
3.540000D 00	1.019060D 03	1.576620D 02	8.569160D-02	1.601720D-01	1.009310D 00	1.024790D-01	3.999870D 03	1.524200D 05	1.259020D 00
3.640000D 00	1.020440D 03	1.577830D 02	8.904270D-02	1.598930D-01	1.007560D 00	1.020080D-01	3.999860D 03	1.524730D 05	1.160080D 00
3.740000D 00	1.021870D 03	1.578940D 02	9.238760D-02	1.596000D-01	1.005710D 00	1.015150D-01	3.999860D 03	1.525220D 05	1.062910D 00
3.840000D 00	1.023360D 03	1.579960D 02	9.572160D-02	1.592930D-01	1.003770D 00	1.010020D-01	3.999860D 03	1.525670D 05	9.676860D-01
3.940000D 00	1.024890D 03	1.580860D 02	9.904010D-02	1.589700D-01	1.001740D 00	1.004680D-01	3.999850D 03	1.526070D 05	8.744300D-01
4.040000D 00	1.026480D 03	1.581710D 02	1.024380D-01	1.586320D-01	9.996090D-01	9.991330D-02	3.999850D 03	1.526440D 05	7.833570D-01
4.140000D 00	1.028120D 03	1.582460D 02	1.056120D-01	1.582780D-01	9.973810D-01	9.933820D-02	3.999840D 03	1.526760D 05	6.945620D-01
4.240000D 00	1.029810D 03	1.583100D 02	1.088860D-01	1.579090D-01	9.950560D-01	9.874360D-02	3.999840D 03	1.527050D 05	6.081140D-01
4.340000D 00	1.031560D 03	1.583660D 02	1.120660D-01	1.575250D-01	9.926360D-01	9.813030D-02	3.999830D 03	1.527300D 05	5.241320D-01
4.440000D 00	1.033360D 03	1.584150D 02	1.152380D-01	1.571260D-01	9.901190D-01	9.749920D-02	3.999830D 03	1.527510D 05	4.426940D-01
4.540000D 00	1.035200D 03	1.584550D 02	1.183670D-01	1.567110D-01	9.875090D-01	9.685110D-02	3.999830D 03	1.527690D 05	3.638800D-01
4.640000D 00	1.037100D 03	1.584880D 02	1.214600D-01	1.562820D-01	9.848060D-01	9.618690D-02	3.999820D 03	1.527830D 05	2.877690D-01
4.740000D 00	1.039040D 03	1.585130D 02	1.244810D-01	1.558380D-01	9.820090D-01	9.550760D-02	3.999820D 03	1.527940D 05	2.144370D-01
4.840000D 00	1.041030D 03	1.585310D 02	1.274870D-01	1.553800D-01	9.791210D-01	9.481380D-02	3.999820D 03	1.528020D 05	1.439840D-01
4.940000D 00	1.043070D 03	1.585420D 02	1.303750D-01	1.549070D-01	9.761420D-01	9.410660D-02	3.999810D 03	1.528070D 05	7.638910D-02
5.040000D 00	1.045160D 03	1.585460D 02	1.332290D-01	1.544200D-01	9.730730D-01	9.338690D-02	3.999810D 03	1.528090D 05	1.180590D-02
5.140000D 00	1.047280D 03	1.585440D 02	1.360160D-01	1.539190D-01	9.699150D-01	9.265540D-02	3.999800D 03	1.528080D 05	-4.973600D-02
5.240000D 00	1.049450D 03	1.585360D 02	1.387330D-01	1.534040D-01	9.666830D-01	9.191310D-02	3.999800D 03	1.528040D 05	-1.081720D-01
5.340000D 00	1.051670D 03	1.585230D 02	1.413750D-01	1.528740D-01	9.633330D-01	9.116070D-02	3.999800D 03	1.527980D 05	-1.634830D-01
5.440000D 00	1.053920D 03	1.585040D 02	1.439400D-01	1.523310D-01	9.599120D-01	9.039930D-02	3.999790D 03	1.527900D 05	-2.158250D-01
5.540000D 00	1.056210D 03	1.584800D 02	1.464230D-01	1.517750D-01	9.564050D-01	8.962960D-02	3.999790D 03	1.527800D 05	-2.643380D-01
5.640000D 00	1.058540D 03	1.584510D 02	1.488220D-01	1.512050D-01	9.528120D-01	8.885230D-02	3.999780D 03	1.527670D 05	-3.098640D-01
5.740000D 00	1.060910D 03	1.584180D 02	1.511330D-01	1.506210D-01	9.491360D-01	8.806640D-02	3.999780D 03	1.527520D 05	-3.519990D-01
5.840000D 00	1.063310D 03	1.583810D 02	1.533520D-01	1.500240D-01	9.453760D-01	8.727870D-02	3.999780D 03	1.527360D 05	-3.907620D-01
5.940000D 00	1.065750D 03	1.583400D 02	1.554760D-01	1.494150D-01	9.415330D-01	8.648400D-02	3.999770D 03	1.527180D 05	-4.260910D-01
6.040000D 00	1.068220D 03	1.582950D 02	1.575060D-01	1.487920D-01	9.376090D-01	8.568500D-02	3.999770D 03	1.526990D 05	-4.579610D-01
6.140000D 00	1.070710D 03	1.582480D 02	1.594340D-01	1.481560D-01	9.336040D-01	8.488270D-02	3.999760D 03	1.526780D 05	-4.863120D-01
6.240000D 00	1.073240D 03	1.581980D 02	1.612590D-01	1.475080D-01	9.295220D-01	8.407810D-02	3.999760D 03	1.526560D 05	-5.111520D-01
6.340000D 00	1.075790D 03	1.581460D 02	1.629780D-01	1.468480D-01	9.253640D-01	8.327210D-02	3.999760D 03	1.526330D 05	-5.324530D-01
6.440000D 00	1.078370D 03	1.580920D 02	1.645890D-01	1.461770D-01	9.211330D-01	8.246590D-02	3.999750D 03	1.526090D 05	-5.501980D-01
6.540000D 00	1.080970D 03	1.580360D 02	1.660900D-01	1.454940D-01	9.168320D-01	8.166020D-02	3.999750D 03	1.525850D 05	-5.643720D-01
6.640000D 00	1.083600D 03	1.579790D 02	1.674780D-01	1.448010D-01	9.124620D-01	8.085600D-02	3.999750D 03	1.525590D 05	-5.749840D-01
6.740000D 00	1.086240D 03	1.579210D 02	1.687510D-01	1.440973D-01	9.080260D-01	8.005410D-02	3.999740D 03	1.525340D 05	-5.819630D-01
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6.940000D 00	1.091580D 03	1.578040D 02	1.709450D-01	1.426590D-01	8.989670D-01	7.846050D-02	3.999730D 03	1.524820D 05	-5.851560D-01
7.040000D 00	1.094270D 03	1.577460D 02	1.718620D-01	1.419260D-01	8.943470D-01	7.767020D-02	3.999730D 03	1.524560D 05	-5.813390D-01
7.140000D 00	1.096970D 03	1.576880D 02	1.726570D-01	1.411840D-01	8.896720D-01	7.688530D-02	3.999730D 03	1.524310D 05	-5.739110D-01
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7.340000D 00	1.102410D 03	1.575760D 02	1.738750D-01	1.396750D-01	8.801610D-01	7.533380D-02	3.999720D 03	1.523810D 05	-5.482240D-01
7.440000D 00	1.105140D 03	1.575220D 02	1.742960D-01	1.389080D-01	8.753310D-01	7.456860D-02	3.999710D 03	1.523570D 05	-5.299730D-01
7.540000D 00	1.107870D 03	1.574760D 02	1.745900D-01	1.381340D-01	8.704530D-01	7.381080D-02	3.999710D 03	1.523340D 05	-5.081240D-01
7.640000D 00	1.110610D 03	1.574200D 02	1.747560D-01	1.373530D-01	8.655310D-01	7.306120D-02	3.999710D 03	1.523120D 05	-4.826870D-01
7.740000D 00	1.113340D 03	1.573730D 02	1.747930D-01	1.365650D-01	8.605670D-01	7.232020D-02	3.999700D 03	1.522920D 05	-4.536760D-01
7.840000D 00	1.116080D 03	1.573300D 02	1.747010D-01	1.357710D-01	8.555630D-01	7.158820D-02	3.999700D 03	1.522720D 05	-4.210960D-01
7.940000D 00	1.118810D 03	1.572890D 02	1.744790D-01	1.349710D-01	8.505220D-01	7.086560D-02	3.999700D 03	1.522540D 05	-3.849710D-01
8.040000D 00	1.121540D 03	1.572530D 02	1.741270D-01	1.341650D-01	8.454460D-01	7.015280D-02	3.999690D 03	1.522380D 05	-3.453150D-01
8.140000D 00	1.124260D 03	1.572200D 02	1.736450D-01	1.333540D-01	8.403370D-01	6.945000D-02	3.999690D 03	1.522240D 05	-3.021810D-01
8.240000D 00	1.126970D 03	1.571920D 02	1.730330D-01	1.325390D-01	8.351980D-01	6.875780D-02	3.999680D 03	1.522110D 05	-2.556990D-01
8.340000D 00	1.129670D 03	1.571690D 02	1.722900D-01	1.317190D-01	8.300310D-01	6.807560D-02	3.999680D 03	1.522010D 05	-2.053870D-01
8.440000D 00	1.132360D 03	1.571520D 02	1.714170D-01	1.308950D-01	8.248390D-01	6.740660D-02	3.999680D 03	1.521930D 05	-1.518420D-01
8.540000D 00	1.135030D 03	1.571390D 02	1.704140D-01	1.300670D-01	8.196240D-01	6.674460D-02	3.999670D 03	1.521870D 05	-9.485590D-02
8.640000D 00	1.137690D 03	1.571330D 02	1.692820D-01	1.292360D-01	8.143890D-01	6.609560D-02	3.999670D 03	1.521850D 05	-3.468090D-02
8.740000D 00	1.140330D 03	1.571320D 02	1.680210D-01	1.284020D-01	8.091360D-01	6.545840D-02	3.999670D 03	1.521840D 05	2.906620D-02
8.840000D 00	1.142950D 03	1.571390D 02	1.666320D-01	1.275680D-01	8.038660D-01	6.483240D-02	3.999660D 03	1.521870D 05	9.600660D-02
8.940000D 00	1.145540D 03	1.571520D 02	1.651160D-01	1.267280D-01	7.985840D-01	6.421800D-02	3.999660D 03	1.521930D 05	1.661980D-01
9.040000D 00	1.148110D 03	1.571720D 02	1.634740D-01	1.258880D-01	7.932900D-01	6.361530D-02	3.999660D 03	1.522020D 05	2.395960D-01
9.140000D 00	1.150660D 03	1.572000D 02	1.617070D-01	1.250460D-01	7.879890D-01	6.302420D-02	3.999650D 03	1.522140D 05	3.161530D-01
9.240000D 00	1.153170D 03	1.572350D 02	1.598160D-01	1.242040D-01	7.826810D-01	6.244490D-02	3.999650D 03	1.522300D 05	3.958180D-01
9.340000D 00	1.155660D 03	1.572790D 02	1.578040D-01	1.233610D-01	7.773700D-01	6.187730D-02	3.999640D 03	1.522500D 05	4.785370D-01
9.440000D 00	1.158120D 03	1.573310D 02	1.556720D-01	1.225180D-01	7.720580D-01	6.132150D-02	3.999640D 03	1.522730D 05	5.642540D-01
9.540000D 00	1.160540D 03	1.573920D 02	1.534170D-01	1.216750D-01	7.667470D-01	6.077740D-02	3.999630D 03	1.523000D 05	6.529090D-01
9.640000D 00	1.162920D 03	1.574620D 02	1.510460D-01	1.208330D-01	7.614600D-01	6.024660D-02	3.999630D 03	1.523310D 05	7.444380D-01
9.740000D 00	1.165280D 03	1.575410D 02	1.485830D-01	1.199910D-01	7.561390D-01	5.972430D-02	3.999630D 03	1.523660D 05	8.387750D-01
9.840000D 00	1.167590D 03	1.576300D 02	1.459860D-01	1.191510D-01	7.508460D-01	5.921510D-02	3.999620D 03	1.524050D 05	9.358810D-01
9.940000D 00	1.169860D 03	1.577280D 02	1.432850D-01	1.183130D-01	7.455640D-01	5.871750D-02	3.999620D 03	1.524490D 05	1.035590D 00
1.004000D 01	1.172090D 03	1.578370D 02	1.404370D-01	1.174770D-01	7.402960D-01	5.823120D-02	3.999610D 03	1.524970D 05	1.137930D 00

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COST FUNCTION(J) = 3.0614483529880126D-04

WITH:

ALTITUDE TOLERANCE = 0.0002171302446D-06

FLIGHT-PATH-ANGLE TOLERANCE = 0.J58bbb32269540-10

FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE = 0.J612J3b4U3e2850-11

WEIGHT TOLERANCE = 0.0

ENERGY TOLERANCE = 0.0.0127733B395593-06

ANGLE-OF-ATTACK TOLERANCE = 0.0

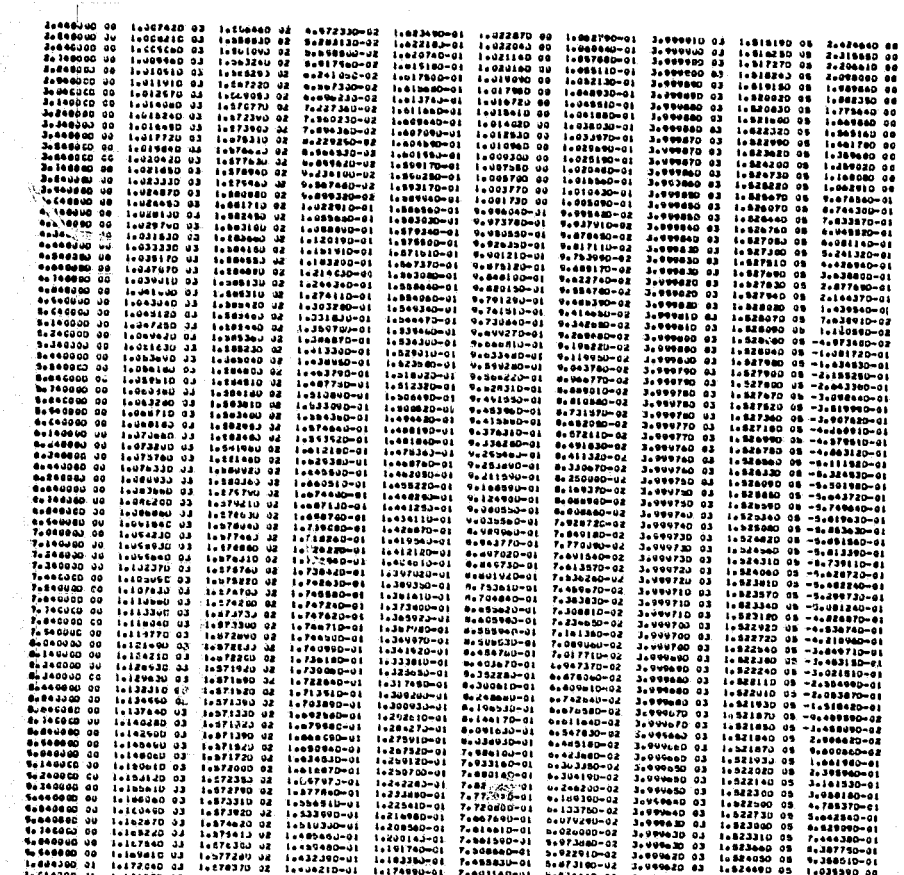
PREVIOUS COEFFICIENT		J.JJUDELTA		NEW COEFFICIENT	
3.2873614141431030 05	+ 1.J00 0.0	=	0.2873614141431000 05		(FROZEN)
0.0	+ 1.000 0.0	=	0.0		(FROZEN)
0.112866206866960 06	+ 1.000 0.0	=	0.112866206866960 06		(FROZEN)
-0.217016371270930 01	+ 1.000 0.0	=	-0.217016371270930 01		(FROZEN)
0.0	+ 1.000 0.0	=	0.0		(FROZEN)
0.3J3106765J2U3530-01	+ 1.J00+0.0	=	0.3J3102225723156U-01		
0.0	+ 1.000 0.0	=	0.0		(FROZEN)
0.12AA5149326B6J 01	+ 1.000 0.0	=	0.12B894A0230960 01		
0.0	+ 1.000 0.0	=	0.0		(FROZEN)
0.2J3221758B713J 00	+ 1.J00+0.0	=	0.2B1664J0B80940 00		
0.7736456572631U-06	+ 1.J00+0.0	=	0.7313J5J2099060-06		
0.43U9577216160U 01	+ 1.J00+0.0	=	0.42499736A90320 01		
-0.9J0B0U2U0621735U-07	+ 1.000 0.0	=	0.363651B6780390-09		

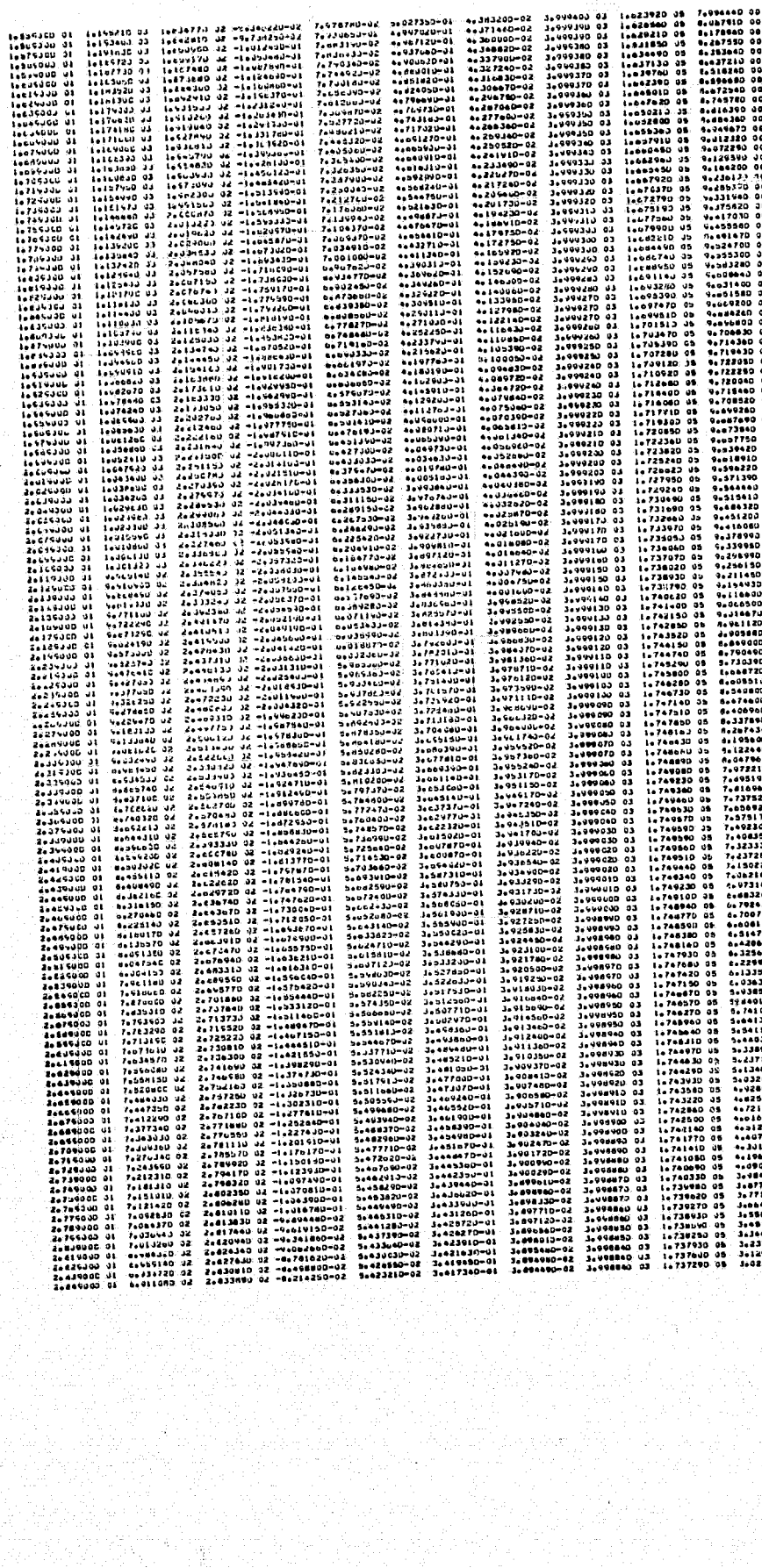
FLIGHT PATH TRAJECTORY PREDICTION

ITERATION # 5

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.eJ0J60 J2	1.e07360 J2	5.1e13e25-05	1.e025710-01	1.e02e270 00	1.e0n6760-01	4.000000 03	1.e73290 05	4.e6e4340 00
1.e000000-02	1.e0J0J0 03	1.e07860 J2	1.e126030-04	1.e025910-01	1.e02e390 00	1.e0n7140-01	4.000000 03	1.e73520 05	4.e6e8260 00
2.e000000-02	1.e0J0J00 03	1.e4d330 02	1.e7e0750-04	1.e025960-01	1.e02e480 00	1.e0e7270-01	4.000000 03	1.e73740 05	4.e6e2470 00
3.e000000-02	1.e0C3C00 03	2.e3e9030-04	1.e026050-01	1.e02e4e0 00	1.e0n7390-01	4.000000 03	1.e73970 05	4.e6e4630 00	
4.e000000-02	1.e0J3J0 03	3.e04e2e0-04	1.e026120-01	1.e02e520 00	1.e0e7520-01	4.000000 03	1.e74200 05	4.e6e4040 00	
5.e000000-02	1.e0J3J0 03	3.e042e70-04	1.e026180-01	1.e02e610 00	1.e0e7760-01	4.000000 03	1.e74440 05	4.e6e2860 00	
6.e000000-02	1.e0C0J0 03	3.e0479e0-04	1.e026230-01	1.e02e6e0 00	1.e0e7990-01	4.000000 03	1.e74680 05	4.e6e2e40 00	
7.e000000-02	1.e0J0C0 03	3.e04e7e0-04	1.e026280-01	1.e02e7b0 00	1.e0e8220-01	4.000000 03	1.e74920 05	4.e6e2e40 00	
8.e000000-02	1.e0J0C0 03	3.e04f020-04	1.e026320-01	1.e02e870 00	1.e0e8450-01	4.000000 03	1.e75160 05	4.e6e2e40 00	
9.e000000-02	1.e0J0J0 03	3.e04f260-04	1.e026360-01	1.e02e930 00	1.e0e8680-01	4.000000 03	1.e75400 05	4.e6e2e40 00	
1.e000000-01	1.e0C0C10 03	3.e04f940 02	8.e7e3250-04	1.e026e50-01	1.e02e9e0 00	1.e0e8710-01	3.999990 03	1.e75e50 05	4.e6f9e80 00
1.e000000-01	1.e0J0J10 03	1.e04f3e0 02	1.e3d110-03	1.e027030-01	1.e02e190 00	1.e0e4170-01	3.999990 03	1.e77340 05	4.e6e4160 00
1.e000000-01	1.e0J0J30 03	1.e07510 02	1.e72e40-03	1.e027270-01	1.e02e250 00	1.e0e9610-01	3.999990 03	1.e77820 05	4.e6e2830 00
1.e000000-01	1.e0J0J30 03	1.e07310 02	2.e0e8950-03	1.e027510-01	1.e02e300 00	1.e0f0860-01	3.999990 03	1.e78100 05	4.e6e1890 00
2.e000000-01	1.e0J0J0 03	1.e07e40 02	2.e1e2160-03	1.e027760-01	1.e02e360 00	1.e0f1e30-01	3.999990 03	1.e78380 05	4.e6e2860 00
2.e000000-01	1.e0C0C50 03	1.e08110 02	2.e497330-03	1.e027a60-01	1.e02e3e0 00	1.e0f2340-01	3.999990 03	1.e78660 05	4.e6e4340 00
3.e000000-01	1.e0J0J70 03	1.e08e40 02	2.e917e20-03	1.e027e70-01	1.e02e4e0 00	1.e0f3880-01	3.999990 03	1.e78e30 05	4.e6e2860 00
3.e000000-01	1.e0J0J10 03	1.e08e4J 02	3.e021680-03	1.e028160-01	1.e02e5e0 00	1.e0f4e30-01	3.999990 03	1.e79120 05	4.e6e2860 00
4.e000000-01	1.e0J0160 03	1.e09710 02	4.e11f00-03	1.e028d80-01	1.e02e8d0 00	1.e0f5240-01	3.999990 03	1.e79e20 05	4.e6e2860 00
4.e000000-01	1.e0J0J50 03	1.e0AJ350 02	5.e0n3110-03	1.e029130-01	1.e02e620 00	1.e0f6e30-01	3.999990 03	1.e7a120 05	4.e6e2860 00
4.e333J03-01	1.e0C0330 03	1.e09e740 02	7.e33e410-03	1.e029e50-01	1.e02ee20 00	1.e0f8240-01	3.999990 03	1.e7a400 05	4.e6e2860 00
7.e000000-01	1.e0J0390 03	1.e0b0070 02	8.e269J00-03	1.e029730-01	1.e02e800 00	1.e0f9e30-01	3.999990 03	1.e7a6e0 05	4.e6e2860 00
8.e000000-01	1.e0J0J30 03	1.e0a173 02	9.e91e850-03	1.e030030-01	1.e02e990 00	1.e0fa420-01	3.999990 03	1.e7a9c0 05	4.e6e2860 00
9.e000000-01	1.e0J0690 03	1.e0b8160 02	1.e18661D-02	1.e030280-01	1.e027130 00	1.e0fb0e0-01	3.999990 03	1.e7ac80 05	4.e6e2860 00
1.e000000-00	1.e0J0B6E 03	1.e12090 02	1.e357110-02	1.e03ue30-01	1.e027e60 00	1.e0fb280-01	3.999990 03	1.e7af60 05	4.e6e2860 00
1.e100000 00	1.e0C1100 03	1.e1J992D 02	1.e59e900-02	1.e030520-01	1.e027300 00	1.e0fb360-01	3.999990 03	1.e7b240 05	4.e6e2860 00
1.e200000 00	1.e0J1360 03	1.e1be50 02	1.e7ae550-02	1.e030e80-01	1.e027310 00	1.e0fb360-01	3.999990 03	1.e7b520 05	4.e6e2860 00
1.e300J00 00	1.e0J1e40 03	1.e223J93 02	1.e987000-02	1.e030480-01	1.e027e83 00	1.e0fb4e0-01	3.999990 03	1.e7b800 05	4.e6e2860 00
1.e400J00 00	1.e0J1960 03	1.e22e43D 02	2.e217330-02	1.e030360-01	1.e027190 00	1.e0fb210-01	3.999990 03	1.e7bae0 05	4.e6e2860 00
1.e500J00 00	1.e0J232C 03	1.e23e4J0 02	2.e487170-02	1.e030130-01	1.e027e80 00	1.e0fb4e0-01	3.999990 03	1.e7bdc0 05	4.e6e2860 00
1.e600J00 00	1.e0C2710 03	1.e23e600 02	2.e706120-02	1.e029810-01	1.e028e80 00	1.e0fc420-01	3.999990 03	1.e7c0a0 05	4.e6e2860 00
1.e700J00 00	1.e0J3190 03	1.e23e310 02	2.e937110-02	1.e029e90-01	1.e029e90 00	1.e0fc9e0-01	3.999990 03	1.e7c380 05	4.e6e2860 00
1.e800J00 00	1.e0J3C60 03	1.e23e4J0 02	3.e229e50-02	1.e028e90-01	1.e02e270 00	1.e0fd9e0-01	3.999990 03	1.e7c660 05	4.e6e2860 00
1.e900J00 00	1.e0J4140 03	1.e242e60 02	3.e303130-02	1.e02e270-01	1.e028e60 00	1.e0f1610-01	3.999990 03	1.e7c940 05	4.e6e2860 00
1.e000000 00	1.e0J4e60 03	1.e25e4J0 02	3.e786150-02	1.e027960-01	1.e028e60 00	1.e0f0160-01	3.999990 03	1.e7c220 05	4.e6e2860 00
2.e050000 00	1.e0J5310 03	1.e26e600 02	4.e072E10-02	1.e028780-01	1.e028e80 00	1.e0fe580-01	3.999990 03	1.e7c500 05	4.e6e2860 00
2.e100J00 00	1.e0J5770 03	1.e27e310 02	4.e38e310-02	1.e028760-01	1.e02e290 00	1.e0e6580-01	3.999990 03	1.e7c7e0 05	4.e6e2860 00
2.e150000 00	1.e0J6670 03	1.e283J03 02	4.e0e6570-02	1.e028e80-01	1.e023620 00	1.e0e4920-01	3.999990 03	1.e7cac0 05	4.e6e2860 00

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COST FUNCTION (J) = 1.294467996907259D-02
WITH:
ALTITUDE TOLERANCE = 0.2863771748919D-02
FLIGHT-PATH-ANGLE TOLERANCE = 0.4448176981654D-09
FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE = 0.7628808784840D-10
WEIGHT TOLERANCE = 0.0
ENERGY TOLERANCE = 0.2863762885183D-02
ANGLE-OF-ATTACK TOLERANCE = 0.0

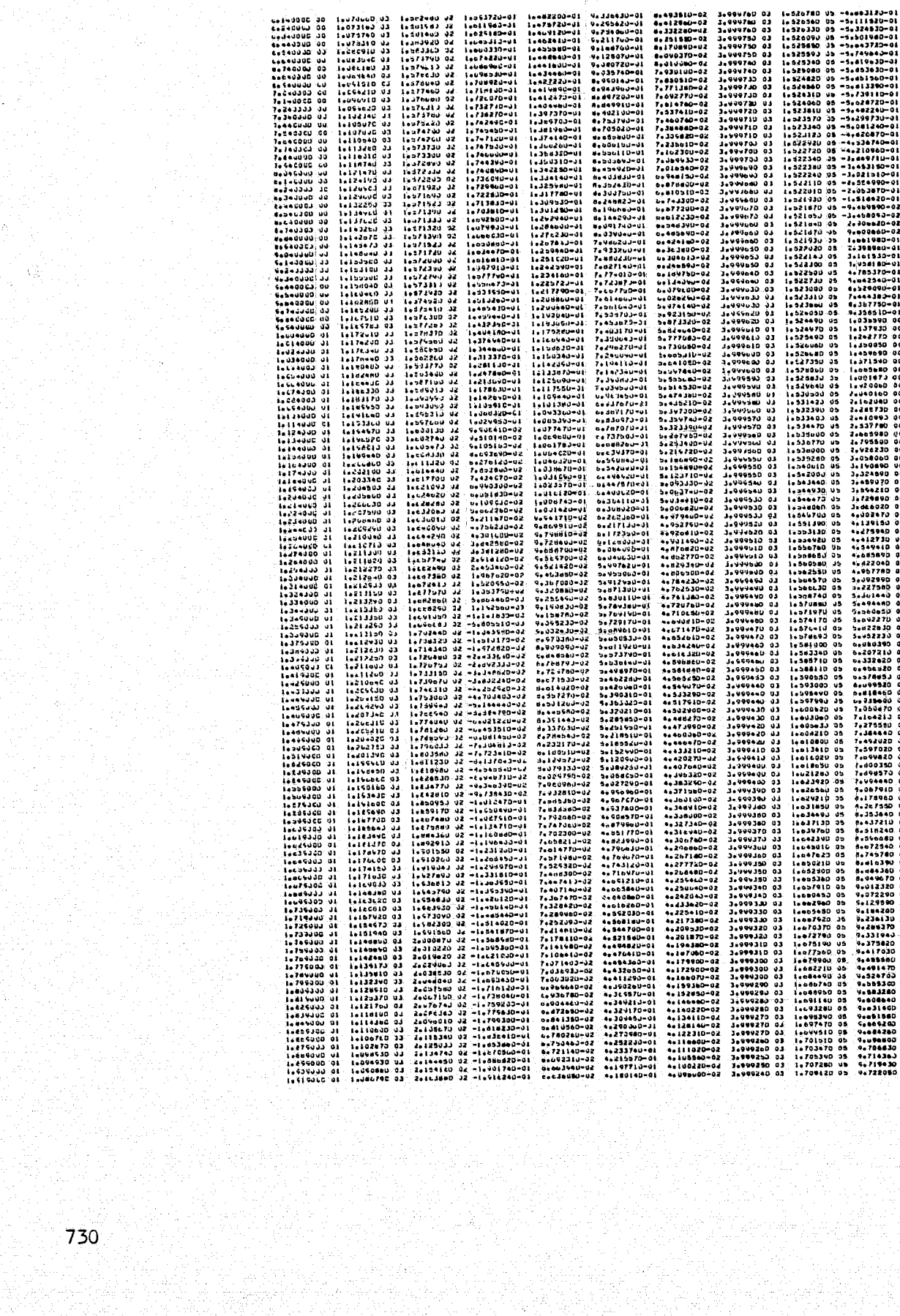
PREVIOUS COEFFICIENT	1.000*DELTA	NEW COEFFICIENT	
0.2873514143100D 05	+ 1.000* 0.0	= 0.2873514143100D 05	(FROZEN)
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.1126642066696D 04	+ 1.000* 0.0	= 0.1126642066696D 04	(FROZEN)
-0.2170163712093D 01	+ 1.000* 0.0	= -0.2170163712093D 01	(FROZEN)
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.3510225723154D-01	+ 1.000* 0.36955192D-05	= 0.3510595275274D-01	
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.1288944802309D 01	+ 1.000*-0.12598035D-02	= 0.1287688129621D 01	
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.2031863008394D 04	+ 1.000*-0.41971775D 00	= 0.2031423288346D 04	
0.7313053209909D-04	+ 1.000*-0.61341155D-04	= 0.1178937687843D-04	
0.6299673589032D 01	+ 1.000*-0.18792197D-04	= 0.6298987796636D 01	
0.5659512678689D-08	+ 1.000*-0.56582003D-05	= 0.3183437004384D-09	(FROZEN)

PREVIOUS COEFFICIENT	1.000*DELTA	NEW COEFFICIENT	
0.2873514143100D 05	+ 1.000* 0.0	= 0.2873514143100D 05	(FROZEN)
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.1126642066696D 04	+ 1.000* 0.0	= 0.1126642066696D 04	(FROZEN)
-0.2170163712093D 01	+ 1.000* 0.0	= -0.2170163712093D 01	(FROZEN)
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.3510225723154D-01	+ 1.000* 0.36955193D-05	= 0.3510595275083D-01	
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.1288944802309D 01	+ 1.000*-0.12598938D-02	= 0.1287688129403D 01	
0.0	+ 1.000* 0.0	= 0.0	(FROZEN)
0.2031863008394D 04	+ 1.000*-0.41971772D 00	= 0.2031423288370D 04	
0.7313053209909D-04	+ 1.000*-0.61341135D-04	= 0.1178937690259D-04	
0.6299673589032D 01	+ 1.000*-0.18792158D-04	= 0.6298987796635D 01	
0.3183437004384D-09	+ 1.000* 0.0	= 0.3183437004384D-09	(FROZEN)

F L I G H T   P A T H   T R A J E C T O R Y   P R E D I C T I O N

ITERATION # 6

TIME (SEC)	ALTITUDE (FT)	AIRSPEED (FT/SEC)	FLIGHT PATH ANGLE (RADIAN)	ANGLE OF ATTACK (RADIAN)	LIFT COEFFICIENT	DRAG COEFFICIENT	WEIGHT (LBF)	POWER AVAILABLE (FT-LBF/SEC)	ACCELERATION (FT/SEC)
0.0	1.000000 03	1.467340 02	5.163420-05	1.625920-01	1.024170 00	1.066780-01	4.000000 03	1.473290 05	4.664040 00
1.000000-02	1.000000 03	1.467860 02	1.122950-04	1.626110-01	1.024290 00	1.067140-01	4.000000 03	1.473520 05	4.658280 00
2.000000-02	1.000000 03	1.468320 02	1.745850-04	1.626180-01	1.024360 00	1.067260-01	4.000000 03	1.473740 05	4.652470 00
3.000000-02	1.000000 03	1.468790 02	2.383110-04	1.626250-01	1.024380 00	1.067390-01	4.000000 03	1.473970 05	4.646630 00
4.000000-02	1.000000 03	1.469250 02	3.034710-04	1.626320-01	1.024430 00	1.067520-01	4.000000 03	1.474200 05	4.640740 00
6.000000-02	1.000000 03	1.470180 02	4.380810-04	1.626460-01	1.024610 00	1.067780-01	4.000000 03	1.474650 05	4.628840 00
8.000000-02	1.000000 03	1.471100 02	5.783940-04	1.626600-01	1.024600 00	1.068010-01	4.000000 03	1.475100 05	4.616790 00
1.000000-01	1.000000 03	1.472020 02	7.243890-04	1.626730-01	1.024680 00	1.068250-01	4.000000 03	1.475550 05	4.604580 00
1.200000-01	1.000010 03	1.472940 02	8.760820-04	1.626860-01	1.024770 00	1.068460-01	4.000000 03	1.476000 05	4.592210 00
1.400000-01	1.000010 03	1.473860 02	1.033330-03	1.626960-01	1.024860 00	1.068730-01	3.999990 03	1.476450 05	4.579680 00
1.800000-01	1.000020 03	1.475690 02	1.364750-03	1.627250-01	1.025010 00	1.069190-01	3.999990 03	1.477340 05	4.554160 00
2.200000-01	1.000030 03	1.477510 02	1.718440-03	1.627500-01	1.025170 00	1.069640-01	3.999990 03	1.478220 05	4.528030 00
2.600000-01	1.000040 03	1.479310 02	2.094250-03	1.627740-01	1.025320 00	1.070080-01	3.999990 03	1.479130 05	4.501290 00
3.000000-01	1.000050 03	1.481110 02	2.451570-03	1.627970-01	1.025470 00	1.070510-01	3.999990 03	1.479960 05	4.473960 00
3.400000-01	1.000070 03	1.482890 02	2.911430-03	1.628200-01	1.025610 00	1.070920-01	3.999990 03	1.480830 05	4.446040 00
4.200000-01	1.000110 03	1.486420 02	3.814780-03	1.628630-01	1.025880 00	1.071690-01	3.999980 03	1.482530 05	4.388490 00
5.000000-01	1.000130 03	1.489910 02	4.802730-03	1.629020-01	1.026130 00	1.072410-01	3.999980 03	1.484210 05	4.328710 00
5.800000-01	1.000220 03	1.493350 02	5.873670-03	1.629390-01	1.026350 00	1.073070-01	3.999980 03	1.485860 05	4.266770 00
6.600000-01	1.000300 03	1.496740 02	7.025950-03	1.629710-01	1.026560 00	1.073660-01	3.999970 03	1.487470 05	4.2027[illegible] 00
7.400000-01	1.000390 03	1.500070 02	8.257800-03	1.630000-01	1.026740 00	1.074180-01	3.999970 03	1.489060 05	4.1367[illegible] 00
8.400000-01	1.000520 03	1.504170 02	9.907070-03	1.630300-01	1.026910 00	1.074730-01	3.999970 03	1.491010 05	4.081630 00
9.400000-01	1.000690 03	1.508180 02	1.167450-02	1.630540-01	1.027080 00	1.075170-01	3.999960 03	1.492900 05	3.963650 00
1.040000 00	1.000880 03	1.512090 02	1.355650-02	1.630710-01	1.027190 00	1.075480-01	3.999960 03	1.494750 05	3.873020 00
1.140000 00	1.001100 03	1.515920 02	1.545440-02	1.630810-01	1.027250 00	1.075660-01	3.999960 03	1.496540 05	3.779850 00
1.240000 00	1.001350 03	1.519650 02	1.764940-02	1.630840-01	1.027270 00	1.075710-01	3.999950 03	1.498290 05	3.684460 00
1.340000 00	1.001640 03	1.523290 02	1.985270-02	1.630790-01	1.027240 00	1.075620-01	3.999950 03	1.499990 05	3.584680 00
1.440000 00	1.001960 03	1.526830 02	2.215520-02	1.630690-01	1.027150 00	1.075370-01	3.999950 03	1.501630 05	3.487350 00
1.540000 00	1.002310 03	1.530260 02	2.455280-02	1.630430-01	1.027010 00	1.074970-01	3.999940 03	1.503220 05	3.386040 00
1.640000 00	1.002710 03	1.533600 02	2.704150-02	1.630120-01	1.026810 00	1.074400-01	3.999940 03	1.504760 05	3.283140 00
1.740000 00	1.003140 03	1.536840 02	2.961690-02	1.629710-01	1.026560 00	1.073650-01	3.999930 03	1.506250 05	3.178840 00
1.840000 00	1.003620 03	1.539960 02	3.227470-02	1.629190-01	1.026230 00	1.072720-01	3.999930 03	1.507680 05	3.073310 00
1.940000 00	1.004140 03	1.542980 02	3.501640-02	1.628580-01	1.025850 00	1.071600-01	3.999930 03	1.509070 05	2.966750 00
2.040000 00	1.004720 03	1.545890 02	3.781960-02	1.627850-01	1.025390 00	1.070290-01	3.999920 03	1.510390 05	2.859340 00
2.140000 00	1.005210 03	1.548690 02	4.069740-02	1.627020-01	1.024860 00	1.068770-01	3.999920 03	1.511670 05	2.751050 00
2.240000 00	1.005960 03	1.551390 02	4.364020-02	1.626070-01	1.024260 00	1.067050-01	3.999920 03	1.512900 05	2.642660 00
2.340000 00	1.006600 03	1.553980 02	4.664240-02	1.625000-01	1.023590 00	1.065130-01	3.999910 03	1.514070 05	2.533730 00
2.440000 00	1.007410 03	1.556460 02	4.969960-02	1.623810-01	1.022840 00	1.062990-01	3.999910 03	1.515190 05	2.424640 00
2.540000 00	1.008210 03	1.558830 02	5.280730-02	1.622500-01	1.022020 00	1.060650-01	3.999900 03	1.516250 05	2.315550 00
2.640000 00	1.009040 03	1.561090 02	5.596060-02	1.621070-01	1.021120 00	1.058090-01	3.999900 03	1.517270 05	2.206610 00
2.740000 00	1.009960 03	1.563240 02	5.915490-02	1.619610-01	1.020140 00	1.055330-01	3.999900 03	1.518240 05	2.098000 00
2.840000 00	1.010900 03	1.565290 02	6.238580-02	1.617830-01	1.019080 00	1.052340-01	3.999890 03	1.519150 05	1.989860 00
2.940000 00	1.011910 03	1.567220 02	6.564780-02	1.616020-01	1.017930 00	1.049140-01	3.999890 03	1.520020 05	1.882350 00
3.040000 00	1.012960 03	1.569050 02	6.893600-02	1.614070-01	1.016710 00	1.045730-01	3.999880 03	1.520830 05	1.775640 00
3.140000 00	1.014070 03	1.570770 02	7.224800-02	1.611990-01	1.015400 00	1.042100-01	3.999880 03	1.521600 05	1.669600 00
3.240000 00	1.015230 03	1.572390 02	7.557690-02	1.609780-01	1.014000 00	1.038250-01	3.999883 03	1.522320 05	1.565160 00
3.340000 00	1.016440 03	1.573900 02	7.891770-02	1.607420-01	1.012520 00	1.034190-01	3.999870 03	1.522990 05	1.461700 00
3.440000 00	1.017710 03	1.575310 02	8.226680-02	1.604930-01	1.010950 00	1.029910-01	3.999873 03	1.523620 05	1.359600 00
3.540000 00	1.019030 03	1.576620 02	8.561910-02	1.602300-01	1.009290 00	1.025410-01	3.999870 03	1.524200 05	1.259020 00
3.640000 00	1.020410 03	1.577830 02	8.897000-02	1.599520-01	1.007540 00	1.020710-01	3.999860 03	1.524730 05	1.160380 00
3.740000 00	1.021840 03	1.578940 02	9.231470-02	1.596590-01	1.005730 00	1.015790-01	3.999860 03	1.525220 05	1.062910 00
3.840000 00	1.023320 03	1.579960 02	9.564850-02	1.593520-01	1.003760 00	1.010650-01	3.999850 03	1.525670 05	9.676560-01
3.940000 00	1.024850 03	1.580880 02	9.896090-02	1.590290-01	1.001730 00	1.005310-01	3.999850 03	1.526070 05	8.744300-01
4.040000 00	1.026440 03	1.581710 02	1.022650-01	1.586910-01	9.996310-01	9.997030-02	3.999850 03	1.526440 05	7.833570-01
4.140000 00	1.028080 03	1.582450 02	1.055380-01	1.583380-01	9.973750-01	9.940120-02	3.999840 03	1.526760 05	6.945620-01
4.240000 00	1.029780 03	1.583100 02	1.087840-01	1.579690-01	9.950530-01	9.880640-02	3.999840 03	1.527050 05	6.081140-01
4.340000 00	1.031520 03	1.583660 02	1.119530-01	1.575850-01	9.926350-01	9.819300-02	3.999830 03	1.527300 05	5.241320-01
4.440000 00	1.033320 03	1.584150 02	1.151650-01	1.571860-01	9.901220-01	9.756160-02	3.999835 03	1.527510 05	4.426940-01
4.540000 00	1.035140 03	1.584550 02	1.182950-01	1.567720-01	9.875140-01	9.691330-02	3.999830 03	1.527690 05	3.638000-01
4.640000 00	1.037060 03	1.584880 02	1.213770-01	1.563440-01	9.848130-01	9.624680-02	3.999820 03	1.527830 05	2.877690-01
4.740000 00	1.039000 03	1.585130 02	1.244090-01	1.559000-01	9.820200-01	9.556900-02	3.999820 03	1.527940 05	2.144370-01
4.840000 00	1.040990 03	1.585310 02	1.273860-01	1.554420-01	9.791340-01	9.487490-02	3.999820 03	1.528020 05	1.439540-01
4.940000 00	1.043030 03	1.585420 02	1.303030-01	1.549690-01	9.761570-01	9.416730-02	3.999810 03	1.528070 05	7.638910-02
5.040000 00	1.045110 03	1.585460 02	1.331560-01	1.544830-01	9.730910-01	9.344710-02	3.999810 03	1.528090 05	1.180590-02
5.140000 00	1.047240 03	1.585440 02	1.359460-01	1.539810-01	9.699360-01	9.271510-02	3.999800 03	1.528080 05	-4.973400-02
5.240000 00	1.049410 03	1.585360 02	1.386610-01	1.534660-01	9.666900-01	9.197220-02	3.999800 03	1.528040 05	-1.081720-01
5.340000 00	1.051620 03	1.585230 02	1.413670-01	1.529370-01	9.633580-01	9.121930-02	3.999800 03	1.527980 05	-1.634830-01
5.440000 00	1.053870 03	1.585060 02	1.438720-01	1.523950-01	9.599330-01	9.045720-02	3.999790 03	1.527900 05	-2.156280-01
5.540000 00	1.056160 03	1.584840 02	1.463500-01	1.518380-01	9.564330-01	8.968670-02	3.999790 03	1.527800 05	-2.643380-01
5.640000 00	1.058490 03	1.584510 02	1.487560-01	1.512680-01	9.528430-01	8.890880-02	3.999780 03	1.527670 05	-3.098440-01
5.740000 00	1.060860 03	1.584180 02	1.510870-01	1.506850-01	9.491680-01	8.812420-02	3.999780 03	1.527520 05	-3.519990-01
5.840000 00	1.063260 03	1.583810 02	1.532080-01	1.500880-01	9.454100-01	8.733370-02	3.999780 03	1.527360 05	-3.907620-01
5.940000 00	1.065690 03	1.583400 02	1.556140-01	1.494780-01	9.415690-01	8.653820-02	3.999770 03	1.527180 05	-4.260910-01
6.040000 00	1.068100 03	1.582950 02	1.574430-01	1.488550-01	9.376460-01	8.573830-02	3.999770 03	1.526990 05	-4.579810-01



ORIGINAL PAGE IS
OF POOR QUALITY



COST FUNCTION (J) = 2.9863899e835e2500-02

WITH:

ALTITUDE TOLERANCE = 0.0800931177966D-02
FLIGHT-PATH-ANGLE TOLERANCE = 0.1056961722687D-08
FLIGHT-PATH-ANGLE-DERIVATIVE TOLERANCE = 0.1986137577745D-09
WEIGHT TOLERANCE = 0.0
ENERGY TOLERANCE = 0.0807984D238093-02
ANGLE-OF-ATTACK TOLERANCE = 0.0

PREVIOUS COEFFICIENT		DELTA		NEW COEFFICIENT	
0.2873514143100D 05	+	1.000 0.0	=	0.2873514143100D 05	(FROZEN)
0.0	+	1.000 0.0	=	0.0	(FROZEN)
0.1126464206666D 06	+	1.000 0.0	=	0.1126464206666D 06	(FROZEN)
-0.2171016371209D 01	+	1.000 0.0	=	-0.2171016371209D 01	(FROZEN)
0.0	+	1.000 0.0	=	0.0	(FROZEN)
0.3510821738346D-01	+	1.000 0.2284637270-05	=	0.3510821738346D-01	
0.0	+	1.000 0.0	=	0.0	(FROZEN)
0.1286390206637D 01	+	1.000 0.1299742420-02	=	0.1286390206637D 01	
0.0	+	1.000 0.0	=	0.0	(FROZEN)
0.2029478339258D 06	+	1.000 0.1464964910 01	=	0.2029478339258D 06	
0.1178037e402590-04	+	1.000 0.1660e6e750-04	=	-0.4907298091123D-05	
0.6298687796835D 01	+	1.000 0.1178339900-03	=	0.6298839928420 01	
0.3183437006384D-09	+	1.000 0.0	=	0.3183437006384D-09	(FROZEN)

MODEL SOLUTIONS

```
*
* MODEL 12   P0 =  2.37571780932D 05    CD0 =  3.36026618L65U-01    CLA0 = -3.69072985961D-05
*            P1 =  0.0                  CD1 =  0.0                  CLA1 =  0.62988396283D 01
* PCENT      P2 =  0.11614201361D 06    CD2 =  0.12761340000D 01    CLA2 =  0.31836370U46D-04
* FAILURES   P3 = -0.22332471613206120D 00   CD3 =  0.0              CLQ  =  0.0
*            P4 =  0.0                  CD4 =  0.20353177040D3186400 03
*
* FIT ERRORS  0.5978044681145DJ40D-05
*
*****************************************************************************
*
**                      MODEL 12 FOUND TO BE BEST FIT                      **
*
*****************************************************************************
```

```
ANGLE-OF-ATTACK CONFIDENCE =  3.88469JU3U92630-05
PITCH ANGLE CONFIDENCE =  U.1941613J0100040-07
```

```
////////////////////////////////////////////////////////////////////////////////
/*                                                                            */
/*  ***FINAL***    GENERAL EXPRESSIONS FOR PLACE, DRAG COEFFICIENT, AND LIFT COEFFICIENT                  */
/*                                                                            */
/*  P = P0 + P1*V** 3.338030-01 + P2*V** 1.0J0000 00 + P3*V** 2.0000000 00 + P4*V** 3.0000000 00         */
/*                                                                            */
/*                  CD = CD0 + CD1*A** 1 + CD2*A** 2 + CD3*A** 3 + CD4*A** 4                              */
/*                                                                            */
/*                       CL = CLA0 + CLA1*A + CLA2*A** 2.3U6210 00 + CLQ*H                                */
/*                                                                            */
/*  WHERE:                                                                    */
/*                                                                            */
/*        V = AIRSPEED(FT/SEC)                                                */
/*        A = ANGLE OF ATTACK(RADIAN)                                         */
/*        H = PITCH RATE(RADIAN/SEC)                                          */
/*                                                                            */
/*       P0 =  0.27571780932D 05    CD0 =  0.33602661BL65U-01    CLA0 = -3.69072985961D-05                */
/*       P1 =  0.0                  CD1 =  0.0                   CLA1 =  0.62988396283D 01                */
/*       P2 =  0.11614201361D 06    CD2 =  0.12761340000D 01     CLA2 =  0.31836370U46D-04                */
/*       P3 = -0.22332471613D 01    CD3 =  0.0                   CLQ  =  0.0                              */
/*       P4 =  0.0                  CD4 =  0.20353177040D3 06                                             */
/*                                                                            */
////////////////////////////////////////////////////////////////////////////////
```

```
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000000 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1626430 00 RADIAN | ALTITUDE RATE     =  0.7546000-02 FT/SEC     *
*          | PITCH RATE      =  0.4738000-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.6900000 00 FT/SEC**2 *
*          | AIRSPEED        =  0.1467400 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  1 | DENSITY         =  0.2204930-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1602600 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024400 01       *
*          | TEMPERATURE     =  0.5220000 03 DEGREES-R | DRAG COEFFICIENT( CD )=  0.1060500 00       *
*          | ACCELERATION    =  0.4000000 01 FT/SEC**2 | POWER AVAILABLE   =  0.1467000 06 FT-LBF/SEC *
*          | ANGLE-OF-ATTACK RATE=  0.3513000-02 RADIAN/SEC | FLIGHT PATH ANGLE =  0.1624000-04 RADIAN *
*                                                                           *
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000000 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1627200 00 RADIAN | ALTITUDE RATE     =  0.1656620+01 FT/SEC     *
*          | PITCH RATE      =  0.7717700-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.9912450 00 FT/SEC**2 *
*          | AIRSPEED        =  0.1467700 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  2 | DENSITY         =  0.2300930-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1602600 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024700 01       *
*          | TEMPERATURE     =  0.5220000 03 DEGREES-R | DRAG COEFFICIENT( CD )=  0.1061080 00       *
*          | ACCELERATION    =  0.4000800 01 FT/SEC**2 | POWER AVAILABLE   =  0.1467000 06 FT-LBF/SEC *
*          | ANGLE-OF-ATTACK RATE=  0.5044000-03 RADIAN/SEC | FLIGHT PATH ANGLE =  0.1128030-03 RADIAN *
*                                                                           *
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000030 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1627750 00 RADIAN | ALTITUDE RATE     =  0.2579500-01 FT/SEC     *
*          | PITCH RATE      =  0.4040740-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.9934080 00 FT/SEC**2 *
*          | AIRSPEED        =  0.1464000 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  3 | DENSITY         =  0.2304700-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1626200 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024700 01       *
*          | TEMPERATURE     =  0.5220000 03 DEGREES-R | DRAG COEFFICIENT( CD )=  0.1061300 00       *
*          | ACCELERATION    =  0.3960350 01 FT/SEC**2 | POWER AVAILABLE   =  0.1467020 06 FT-LBF/SEC *
*          | ANGLE-OF-ATTACK RATE=  0.8031800-03 RADIAN/SEC | FLIGHT PATH ANGLE =  0.1756800-03 RADIAN *
*                                                                           *
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000000 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1626670 00 RADIAN | ALTITUDE RATE     =  0.3324400-01 FT/SEC     *
*          | PITCH RATE      =  0.6722100-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.9956640 00 FT/SEC**2 *
*          | AIRSPEED        =  0.1466800 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  4 | DENSITY         =  0.2300930-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1626630 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024750 01       *
*          | TEMPERATURE     =  0.5220000 03 DEGREES-R | DRAG COEFFICIENT( CD )=  0.1061110 00       *
*          | ACCELERATION    =  0.4004800 01 FT/SEC**2 | POWER AVAILABLE   =  0.1467040 06 FT-LBF/SEC *
*          | ANGLE-OF-ATTACK RATE=  0.7219000-03 RADIAN/SEC | FLIGHT PATH ANGLE =  0.2239850-03 RADIAN *
*                                                                           *
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000000 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1626400 00 RADIAN | ALTITUDE RATE     =  0.4449000-01 FT/SEC     *
*          | PITCH RATE      =  0.7334600-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.9972800 00 FT/SEC**2 *
*          | AIRSPEED        =  0.1469400 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  5 | DENSITY         =  0.2300930-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1626300 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024680 01       *
*          | TEMPERATURE     =  0.5220000 03 DEGREES-R | DRAG COEFFICIENT( CD )=  0.1061200 00       *
*          | ACCELERATION    =  0.4004700 01 FT/SEC**2 | POWER AVAILABLE   =  0.1467080 06 FT-LBF/SEC *
*          | ANGLE-OF-ATTACK RATE=  0.6062650-03 RADIAN/SEC | FLIGHT PATH ANGLE =  0.2306600-03 RADIAN *
*                                                                           *
*****************************************************************************
*                                                                           *
*          | WEIGHT          =  0.4000000 06 LBF  | ALTITUDE          =  0.100000 06 FT          *
*          | PITCH ANGLE     =  0.1626000 00 RADIAN | ALTITUDE RATE     =  0.6668850-01 FT/SEC     *
*          | PITCH RATE      =  0.7661100-02 RADIAN/SEC | ALTITUDE-RATE RATE =  0.1002060 01 FT/SEC**2 *
*          | AIRSPEED        =  0.1467320 03 FT/SEC | VERTICAL ACCELERATION =  0.0  FT/SEC**2     *
* DATA PT  6 | DENSITY         =  0.2300930-02 SLUG/FT**3 | ELEVATOR DEFLECTION =  0.0  RADIAN       *
*          | ANGLE OF ATTACK =  0.1626850 00 RADIAN | LIFT COEFFICIENT( CL )=  0.1024690 01       *
*                                                                           *
*****************************************************************************
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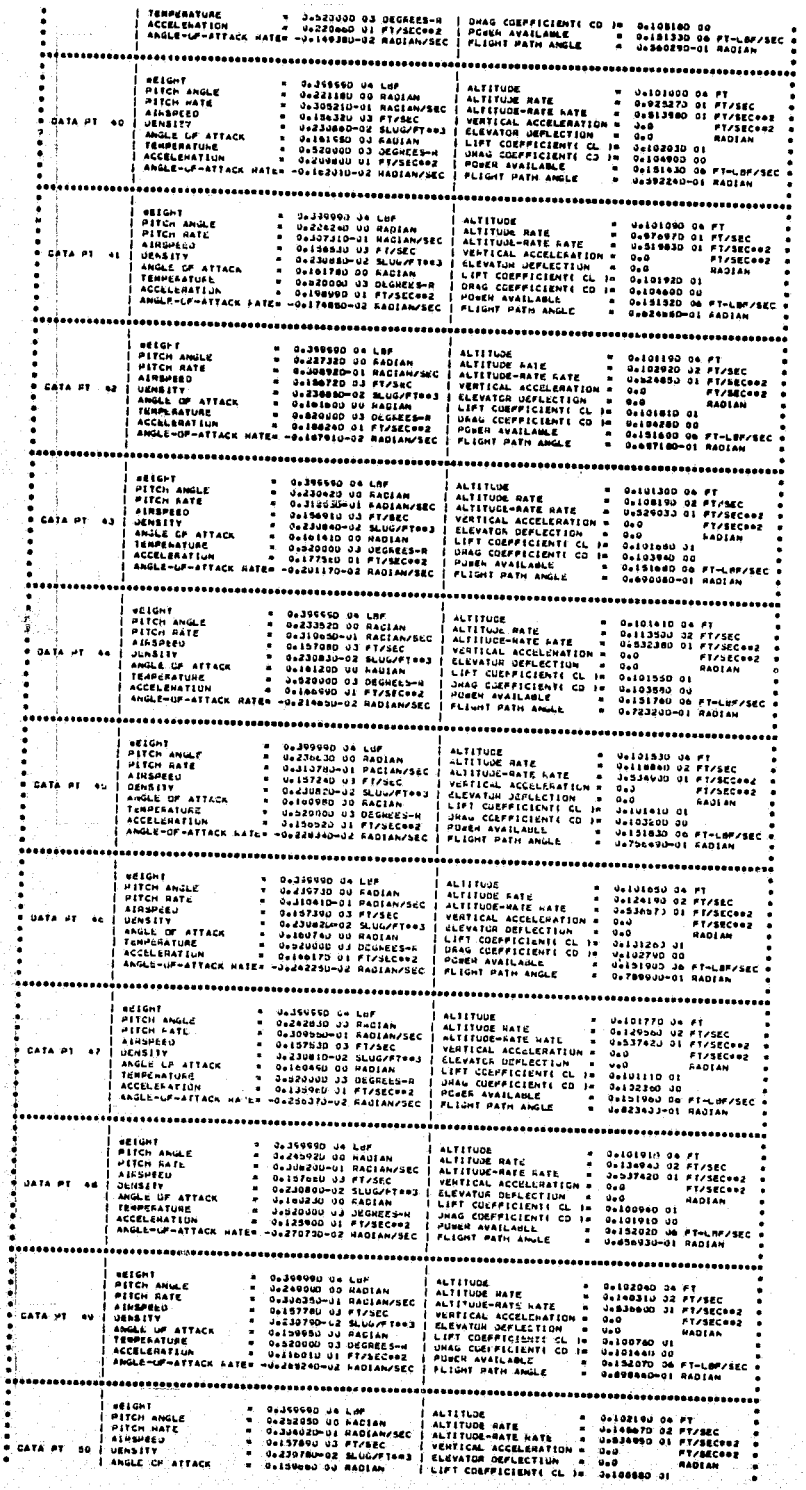
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	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000-01	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
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	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000-01	FT/SEC
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.106170 00	
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	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000-01	FT/SEC
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
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	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000-01	FT/SEC
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.106170 00	
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	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000-01	FT/SEC
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	ACCELERATION	= 0.000000 00 FT/SEC**2	POWER AVAILABLE	= 0.147110 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.000000-03 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.000000-02	RADIAN
	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
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	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.106170 00	
	ACCELERATION	= 0.000000 00 FT/SEC**2	POWER AVAILABLE	= 0.147110 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.000000-03 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.000000-02	RADIAN
	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.106170 00	
	ACCELERATION	= 0.000000 00 FT/SEC**2	POWER AVAILABLE	= 0.147110 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.000000-03 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.000000-02	RADIAN
	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
DATA PT 14	AIRSPEED	= 0.147110 03 FT/SEC	VERTICAL ACCELERATION	= 0.000000 00	FT/SEC**2
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
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	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
DATA PT 15	AIRSPEED	= 0.147110 03 FT/SEC	VERTICAL ACCELERATION	= 0.000000 00	FT/SEC**2
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
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	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
DATA PT 16	AIRSPEED	= 0.147110 03 FT/SEC	VERTICAL ACCELERATION	= 0.000000 00	FT/SEC**2
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	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.106170 00	
	ACCELERATION	= 0.000000 00 FT/SEC**2	POWER AVAILABLE	= 0.147110 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.000000-03 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.000000-02	RADIAN
	WEIGHT	= 0.400000 06 LBF	ALTITUDE	= 0.100000 06	FT
	PITCH ANGLE	= 0.103240 00 RADIAN	ALTITUDE RATE	= 0.000000 00	FT/SEC
	PITCH RATE	= 0.000000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.000000 01	FT/SEC**2
DATA PT 17	AIRSPEED	= 0.147110 03 FT/SEC	VERTICAL ACCELERATION	= 0.000000 00	FT/SEC**2
	DENSITY	= 0.000000-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.000000 00	RADIAN
	ANGLE OF ATTACK	= 0.162810 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102690 01	

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	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100020 06	FT
	PITCH ANGLE	= 0.108840 00	RADIAN	ALTITUDE RATE	= 0.881130 00	FT/SEC
	PITCH RATE	= 0.143640-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.210020 01	FT/SEC**2
	AIRSPEED	= 0.149330 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 18	DENSITY	= 0.230930-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
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	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106640 00	
	ACCELERATION	= 0.426680 01	FT/SEC**2	POWER AVAILABLE	= 0.148220 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.428130-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.390020-02	RADIAN
	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100030 06	FT
	PITCH ANGLE	= 0.173020 00	RADIAN	ALTITUDE RATE	= 0.105630 01	FT/SEC
	PITCH RATE	= 0.192210-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.212470 01	FT/SEC**2
	AIRSPEED	= 0.149670 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 19	DENSITY	= 0.230930-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.102970 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102680 01	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106760 00	
	ACCELERATION	= 0.420280 01	FT/SEC**2	POWER AVAILABLE	= 0.148060 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.381910-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.706550-02	RADIAN
	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100040 06	FT
	PITCH ANGLE	= 0.171290 00	RADIAN	ALTITUDE RATE	= 0.126350 01	FT/SEC
	PITCH RATE	= 0.172570-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.442270 01	FT/SEC**2
	AIRSPEED	= 0.150020 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 20	DENSITY	= 0.230930-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.103030 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102700 01	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106790 00	
	ACCELERATION	= 0.413880 01	FT/SEC**2	POWER AVAILABLE	= 0.148040 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.333850-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.826900-02	RADIAN
	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100050 06	FT
	PITCH ANGLE	= 0.172670 00	RADIAN	ALTITUDE RATE	= 0.149990 01	FT/SEC
	PITCH RATE	= 0.173410-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.260950 01	FT/SEC**2
	AIRSPEED	= 0.150420 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
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	ANGLE OF ATTACK	= 0.103030 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102720 01	
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	PITCH RATE	= 0.184480-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.280350 01	FT/SEC**2
	AIRSPEED	= 0.150820 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
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	ANGLE OF ATTACK	= 0.103050 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102730 01	
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	ANGLE-OF-ATTACK RATE=	0.260900-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.117130-01	RADIAN
	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100090 06	FT
	PITCH ANGLE	= 0.176770 00	RADIAN	ALTITUDE RATE	= 0.223690 01	FT/SEC
	PITCH RATE	= 0.195490-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.290710 01	FT/SEC**2
	AIRSPEED	= 0.151210 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
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	ACCELERATION	= 0.387300 01	FT/SEC**2	POWER AVAILABLE	= 0.149100 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.237100-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.135980-01	RADIAN
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	PITCH RATE	= 0.203310-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.316580 01	FT/SEC**2
	AIRSPEED	= 0.151790 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
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	ACCELERATION	= 0.377440 01	FT/SEC**2	POWER AVAILABLE	= 0.149280 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.214610-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.156930-01	RADIAN
	WEIGHT	= 0.400000 06	LBF	ALTITUDE	= 0.100130 06	FT
	PITCH ANGLE	= 0.181070 00	RADIAN	ALTITUDE RATE	= 0.268990 01	FT/SEC
	PITCH RATE	= 0.211940-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.333910 01	FT/SEC**2
	AIRSPEED	= 0.152170 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 25	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.103080 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102750 01	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106940 00	
	ACCELERATION	= 0.368090 01	FT/SEC**2	POWER AVAILABLE	= 0.149400 06	FT-LBF/SEC
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	WEIGHT	= 0.399990 06	LBF	ALTITUDE	= 0.100160 06	FT
	PITCH ANGLE	= 0.182480 00	RADIAN	ALTITUDE RATE	= 0.303130 01	FT/SEC
	PITCH RATE	= 0.223660-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.350700 01	FT/SEC**2
	AIRSPEED	= 0.152330 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 26	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.103090 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102740 01	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106930 00	
	ACCELERATION	= 0.358090 01	FT/SEC**2	POWER AVAILABLE	= 0.149620 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.925930-04	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.199310-01	RADIAN
	WEIGHT	= 0.399990 06	LBF	ALTITUDE	= 0.100200 06	FT
	PITCH ANGLE	= 0.183270 00	RADIAN	ALTITUDE RATE	= 0.339020 01	FT/SEC
	PITCH RATE	= 0.233910-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.386900 01	FT/SEC**2
	AIRSPEED	= 0.152680 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 27	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.103070 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102730 01	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106910 00	
	ACCELERATION	= 0.346730 01	FT/SEC**2	POWER AVAILABLE	= 0.149780 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	0.817930-04	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.222080-01	RADIAN
	WEIGHT	= 0.399990 06	LBF	ALTITUDE	= 0.100230 06	FT
	PITCH ANGLE	= 0.187650 00	RADIAN	ALTITUDE RATE	= 0.378490 01	FT/SEC
	PITCH RATE	= 0.240150-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.382500 01	FT/SEC**2
	AIRSPEED	= 0.153030 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 28	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.103030 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102720 01	

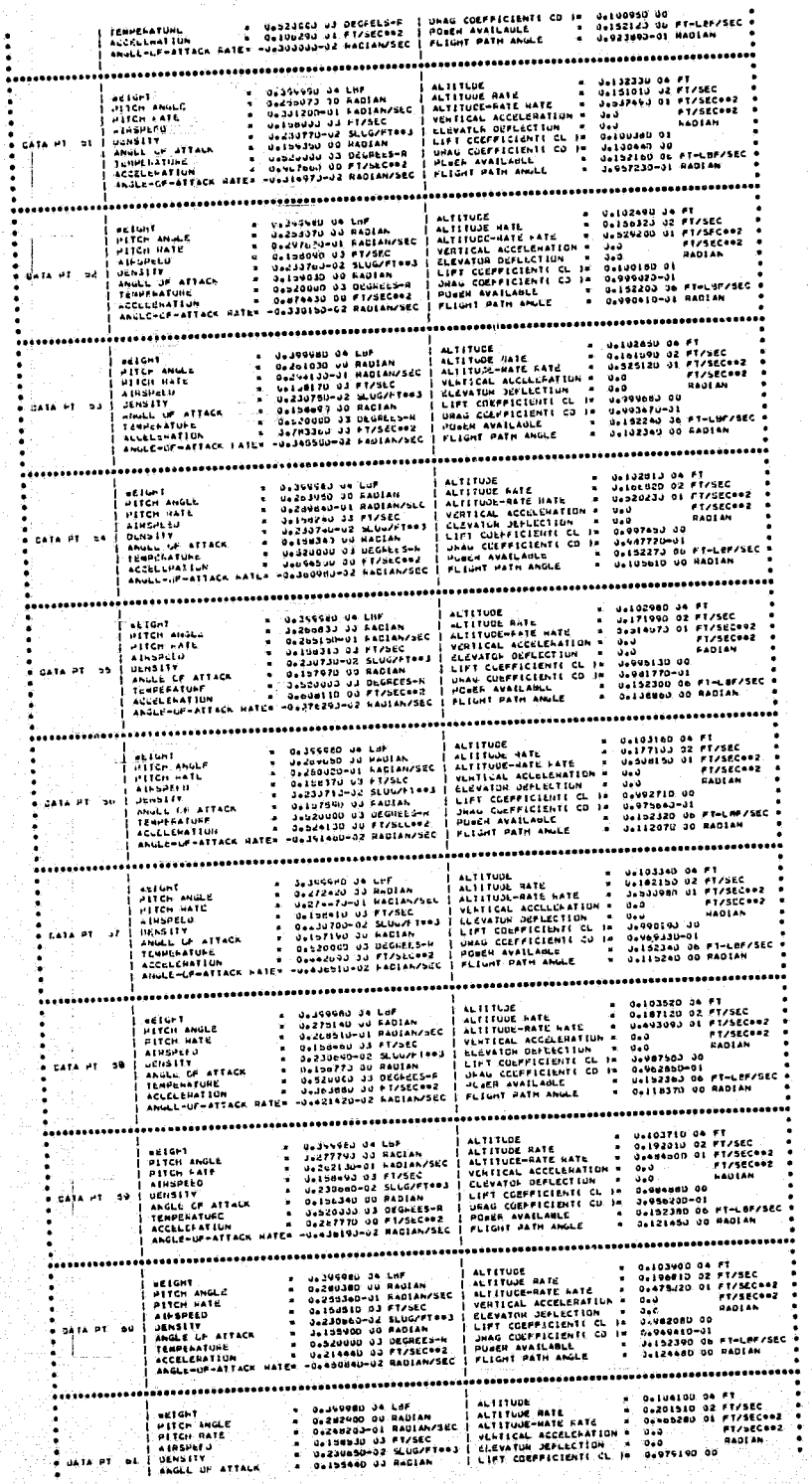
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	WEIGHT	= 0.399990 04	LBF	ALTITUDE	= 0.101270 05	FT	
	PITCH ANGLE	= 0.193110 00	RADIAN	ALTITUDE RATE	= 0.615500 01	FT/SEC	
	PITCH RATE	= 0.244850-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.397600 01	FT/SEC**2	
	AIRSPEED	= 0.153380 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 29	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.101010 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102700 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106610 00		
	ACCELERATION	= 0.328310 01	FT/SEC**2	POWER AVAILABLE	= 0.150390 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.301080-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.270960-01	RADIAN	
	WEIGHT	= 0.399980 04	LBF	ALTITUDE	= 0.100320 05	FT	
	PITCH ANGLE	= 0.192040 00	RADIAN	ALTITUDE RATE	= 0.659060 01	FT/SEC	
	PITCH RATE	= 0.257310-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.411760 01	FT/SEC**2	
	AIRSPEED	= 0.153480 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 30	DENSITY	= 0.230910-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102970 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102710 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106730 00		
	ACCELERATION	= 0.317880 01	FT/SEC**2	POWER AVAILABLE	= 0.150260 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.409610-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.296730-01	RADIAN	
	WEIGHT	= 0.399660 04	LBF	ALTITUDE	= 0.100360 05	FT	
	PITCH ANGLE	= 0.193250 00	RADIAN	ALTITUDE RATE	= 0.497820 01	FT/SEC	
	PITCH RATE	= 0.262290-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.625370 01	FT/SEC**2	
	AIRSPEED	= 0.154000 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 31	DENSITY	= 0.233000-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102920 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102800 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106940 00		
	ACCELERATION	= 0.307330 01	FT/SEC**2	POWER AVAILABLE	= 0.150360 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.382130-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.323330-01	RADIAN	
	WEIGHT	= 0.399590 04	LBF	ALTITUDE	= 0.100410 05	FT	
	PITCH ANGLE	= 0.197930 00	RADIAN	ALTITUDE RATE	= 0.561010 01	FT/SEC	
	PITCH RATE	= 0.270780-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.438240 01	FT/SEC**2	
	AIRSPEED	= 0.154300 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 32	DENSITY	= 0.230920-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102860 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102800 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106630 00		
	ACCELERATION	= 0.296090 01	FT/SEC**2	POWER AVAILABLE	= 0.150320 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.666320-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.350700-01	RADIAN	
	WEIGHT	= 0.399490 04	LBF	ALTITUDE	= 0.100470 05	FT	
	PITCH ANGLE	= 0.200670 00	RADIAN	ALTITUDE RATE	= 0.545400 01	FT/SEC	
	PITCH RATE	= 0.278790-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.450460 01	FT/SEC**2	
	AIRSPEED	= 0.154690 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 33	DENSITY	= 0.230900-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102790 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102550 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106400 00		
	ACCELERATION	= 0.285930 01	FT/SEC**2	POWER AVAILABLE	= 0.150050 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.780630-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.378810-01	RADIAN	
	WEIGHT	= 0.399390 04	LBF	ALTITUDE	= 0.100530 05	FT	
	PITCH ANGLE	= 0.203400 00	RADIAN	ALTITUDE RATE	= 0.631000 01	FT/SEC	
	PITCH RATE	= 0.282330-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.461840 01	FT/SEC**2	
	AIRSPEED	= 0.154070 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 34	DENSITY	= 0.230950-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102710 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102510 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106250 00		
	ACCELERATION	= 0.275120 01	FT/SEC**2	POWER AVAILABLE	= 0.150780 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.894120-03	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.407600-01	RADIAN	
	WEIGHT	= 0.399660 04	LBF	ALTITUDE	= 0.100500 05	FT	
	PITCH ANGLE	= 0.206310 00	RADIAN	ALTITUDE RATE	= 0.677610 01	FT/SEC	
	PITCH RATE	= 0.267340-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.472040 01	FT/SEC**2	
	AIRSPEED	= 0.155140 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 35	DENSITY	= 0.230850-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102610 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102440 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106080 00		
	ACCELERATION	= 0.266270 01	FT/SEC**2	POWER AVAILABLE	= 0.150900 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.100980-02	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.437040-01	RADIAN	
	WEIGHT	= 0.399550 04	LBF	ALTITUDE	= 0.100670 05	FT	
	PITCH ANGLE	= 0.209210 00	RADIAN	ALTITUDE RATE	= 0.729560 01	FT/SEC	
	PITCH RATE	= 0.291690-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.482630 01	FT/SEC**2	
	AIRSPEED	= 0.155400 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 36	DENSITY	= 0.230880-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102500 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102370 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.106880 00		
	ACCELERATION	= 0.253370 01	FT/SEC**2	POWER AVAILABLE	= 0.151020 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.112770-02	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.467080-01	RADIAN	
	WEIGHT	= 0.399980 04	LBF	ALTITUDE	= 0.100740 05	FT	
	PITCH ANGLE	= 0.212150 00	RADIAN	ALTITUDE RATE	= 0.774270 01	FT/SEC	
	PITCH RATE	= 0.299530-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.491520 01	FT/SEC**2	
	AIRSPEED	= 0.155880 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 37	DENSITY	= 0.230880-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102380 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102300 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.105670 00		
	ACCELERATION	= 0.242680 01	FT/SEC**2	POWER AVAILABLE	= 0.151130 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.124760-02	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.497660-01	RADIAN	
	WEIGHT	= 0.399980 04	LBF	ALTITUDE	= 0.100820 05	FT	
	PITCH ANGLE	= 0.215120 00	RADIAN	ALTITUDE RATE	= 0.823860 01	FT/SEC	
	PITCH RATE	= 0.299530-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.499820 01	FT/SEC**2	
	AIRSPEED	= 0.155880 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 38	DENSITY	= 0.230870-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102280 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102220 01		
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.105630 00		
	ACCELERATION	= 0.231650 01	FT/SEC**2	POWER AVAILABLE	= 0.151230 06	FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.136970-02	RADIAN/SEC	FLIGHT PATH ANGLE	= 0.528750-01	RADIAN	
	WEIGHT	= 0.399940 04	LBF	ALTITUDE	= 0.100910 05	FT	
	PITCH ANGLE	= 0.218140 00	RADIAN	ALTITUDE RATE	= 0.874200 01	FT/SEC	
	PITCH RATE	= 0.302620-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.507310 01	FT/SEC**2	
	AIRSPEED	= 0.156110 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2	
DATA PT 39	DENSITY	= 0.230870-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN	
	ANGLE OF ATTACK	= 0.102110 00	RADIAN	LIFT COEFFICIENT(CL)=	0.102120 01		



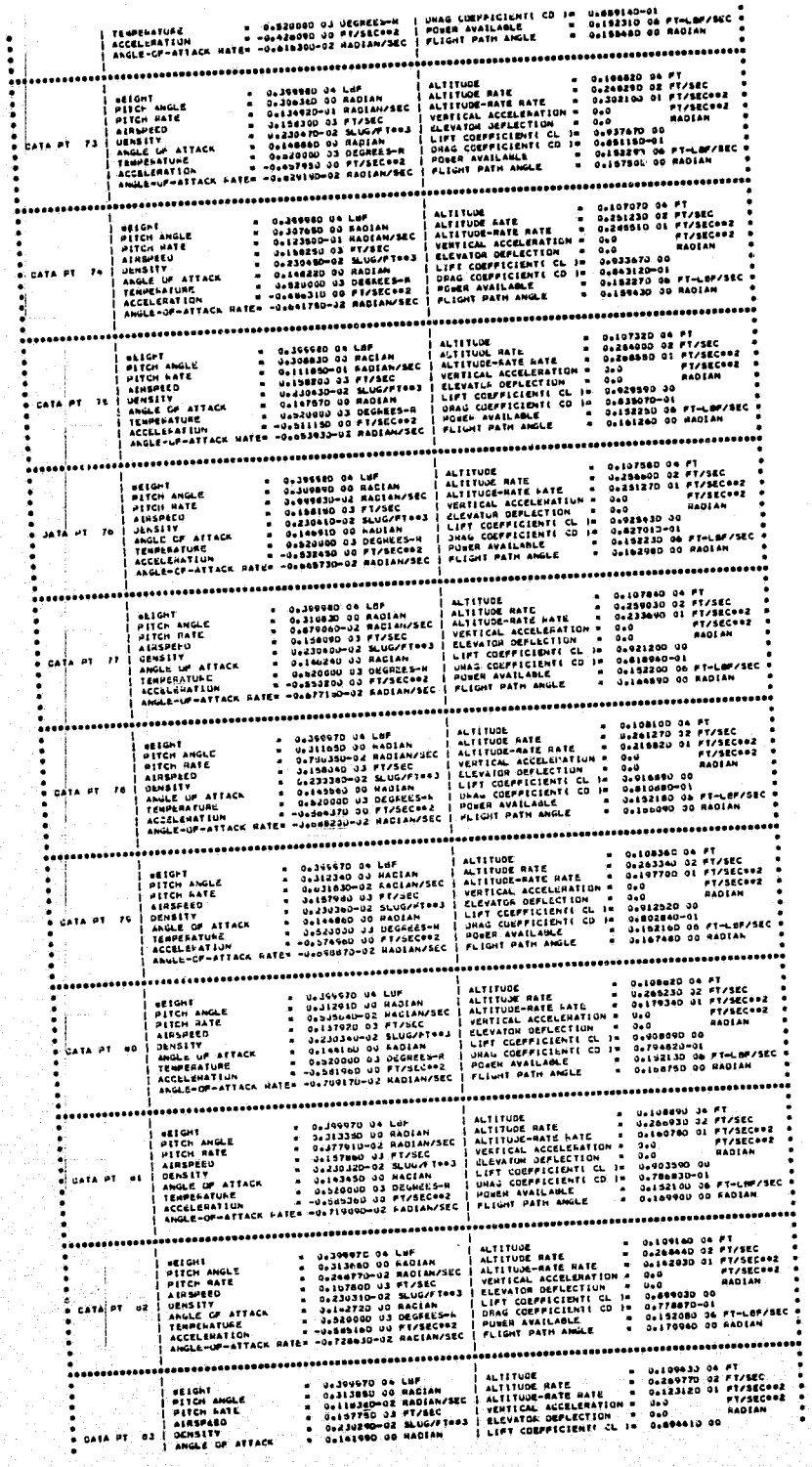
	TEMPERATURE	= 0.520300 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.108180 00	
	ACCELERATION	= 0.220000 01 FT/SEC**2	POWER AVAILABLE	= 0.181330 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.149380-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.360290-01	RADIAN
DATA PT 40	WEIGHT	= 0.395550 04 LBF	ALTITUDE	= 0.101000 06	FT
	PITCH ANGLE	= 0.221180 00 RADIAN	ALTITUDE RATE	= 0.925270 01	FT/SEC
	PITCH RATE	= 0.305210-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.813980 01	FT/SEC**2
	AIRSPEED	= 0.156320 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230880-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.161580 00 RADIAN	LIFT COEFFICIENT(CL)=	0.102030 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.104900 00	
	ACCELERATION	= 0.220000 01 FT/SEC**2	POWER AVAILABLE	= 0.191630 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.162010-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.392260-01	RADIAN
DATA PT 41	WEIGHT	= 0.395090 04 LBF	ALTITUDE	= 0.101090 06	FT
	PITCH ANGLE	= 0.226260 00 RADIAN	ALTITUDE RATE	= 0.976970 01	FT/SEC
	PITCH RATE	= 0.307310-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.819830 01	FT/SEC**2
	AIRSPEED	= 0.156530 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230880-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.161780 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101920 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.104600 00	
	ACCELERATION	= 0.198090 01 FT/SEC**2	POWER AVAILABLE	= 0.191320 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.174850-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.826860-01	RADIAN
DATA PT 42	WEIGHT	= 0.395090 04 LBF	ALTITUDE	= 0.101190 06	FT
	PITCH ANGLE	= 0.227320 00 RADIAN	ALTITUDE RATE	= 0.102920 02	FT/SEC
	PITCH RATE	= 0.308980-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.826850 01	FT/SEC**2
	AIRSPEED	= 0.156720 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230880-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.161800 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101810 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.104280 00	
	ACCELERATION	= 0.186240 01 FT/SEC**2	POWER AVAILABLE	= 0.191600 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.167810-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.687180-01	RADIAN
DATA PT 43	WEIGHT	= 0.395550 04 LBF	ALTITUDE	= 0.101300 06	FT
	PITCH ANGLE	= 0.230020 00 RADIAN	ALTITUDE RATE	= 0.108190 02	FT/SEC
	PITCH RATE	= 0.312030-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.829030 01	FT/SEC**2
	AIRSPEED	= 0.156490 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230860-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.161610 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101680 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.103940 00	
	ACCELERATION	= 0.177580 01 FT/SEC**2	POWER AVAILABLE	= 0.191680 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.201170-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.690080-01	RADIAN
DATA PT 44	WEIGHT	= 0.395550 04 LBF	ALTITUDE	= 0.101410 06	FT
	PITCH ANGLE	= 0.233520 00 RADIAN	ALTITUDE RATE	= 0.113530 02	FT/SEC
	PITCH RATE	= 0.319650-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.832380 01	FT/SEC**2
	AIRSPEED	= 0.157080 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230830-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.161200 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101550 01	
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	ACCELERATION	= 0.166490 01 FT/SEC**2	POWER AVAILABLE	= 0.191780 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.214650-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.723200-01	RADIAN
DATA PT 45	WEIGHT	= 0.395990 04 LBF	ALTITUDE	= 0.101530 06	FT
	PITCH ANGLE	= 0.230630 00 RADIAN	ALTITUDE RATE	= 0.118880 02	FT/SEC
	PITCH RATE	= 0.317030-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.834900 01	FT/SEC**2
	AIRSPEED	= 0.157240 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230820-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.160980 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101610 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.103600 00	
	ACCELERATION	= 0.150930 01 FT/SEC**2	POWER AVAILABLE	= 0.191830 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.228340-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.756690-01	RADIAN
DATA PT 46	WEIGHT	= 0.395990 04 LBF	ALTITUDE	= 0.101650 06	FT
	PITCH ANGLE	= 0.233730 00 RADIAN	ALTITUDE RATE	= 0.126190 02	FT/SEC
	PITCH RATE	= 0.310410-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.838690 01	FT/SEC**2
	AIRSPEED	= 0.157390 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230820-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.160740 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101260 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.102790 00	
	ACCELERATION	= 0.166170 01 FT/SEC**2	POWER AVAILABLE	= 0.191900 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.242250-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.788900-01	RADIAN
DATA PT 47	WEIGHT	= 0.395550 04 LBF	ALTITUDE	= 0.101770 06	FT
	PITCH ANGLE	= 0.242630 00 RADIAN	ALTITUDE RATE	= 0.129560 02	FT/SEC
	PITCH RATE	= 0.309990-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.837420 01	FT/SEC**2
	AIRSPEED	= 0.157530 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230810-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.160460 00 RADIAN	LIFT COEFFICIENT(CL)=	0.101110 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.102360 00	
	ACCELERATION	= 0.143960 01 FT/SEC**2	POWER AVAILABLE	= 0.191960 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.258030-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.823430-01	RADIAN
DATA PT 48	WEIGHT	= 0.395990 04 LBF	ALTITUDE	= 0.101910 06	FT
	PITCH ANGLE	= 0.245920 00 RADIAN	ALTITUDE RATE	= 0.134940 02	FT/SEC
	PITCH RATE	= 0.308200-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.837420 01	FT/SEC**2
	AIRSPEED	= 0.157680 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230800-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.160240 00 RADIAN	LIFT COEFFICIENT(CL)=	0.100980 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.101910 00	
	ACCELERATION	= 0.125900 01 FT/SEC**2	POWER AVAILABLE	= 0.192020 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.270730-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.856930-01	RADIAN
DATA PT 49	WEIGHT	= 0.395990 04 LBF	ALTITUDE	= 0.102060 06	FT
	PITCH ANGLE	= 0.248900 00 RADIAN	ALTITUDE RATE	= 0.140310 02	FT/SEC
	PITCH RATE	= 0.310350-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.838600 01	FT/SEC**2
	AIRSPEED	= 0.157780 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230790-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.159950 00 RADIAN	LIFT COEFFICIENT(CL)=	0.100780 01	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.101640 00	
	ACCELERATION	= 0.110010 01 FT/SEC**2	POWER AVAILABLE	= 0.192070 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.289240-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.898440-01	RADIAN
DATA PT 50	WEIGHT	= 0.395980 04 LBF	ALTITUDE	= 0.102190 06	FT
	PITCH ANGLE	= 0.252850 00 RADIAN	ALTITUDE RATE	= 0.146670 02	FT/SEC
	PITCH RATE	= 0.314020-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.838950 01	FT/SEC**2
	AIRSPEED	= 0.157800 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.230780-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.159680 00 RADIAN	LIFT COEFFICIENT(CL)=	0.100580 01	

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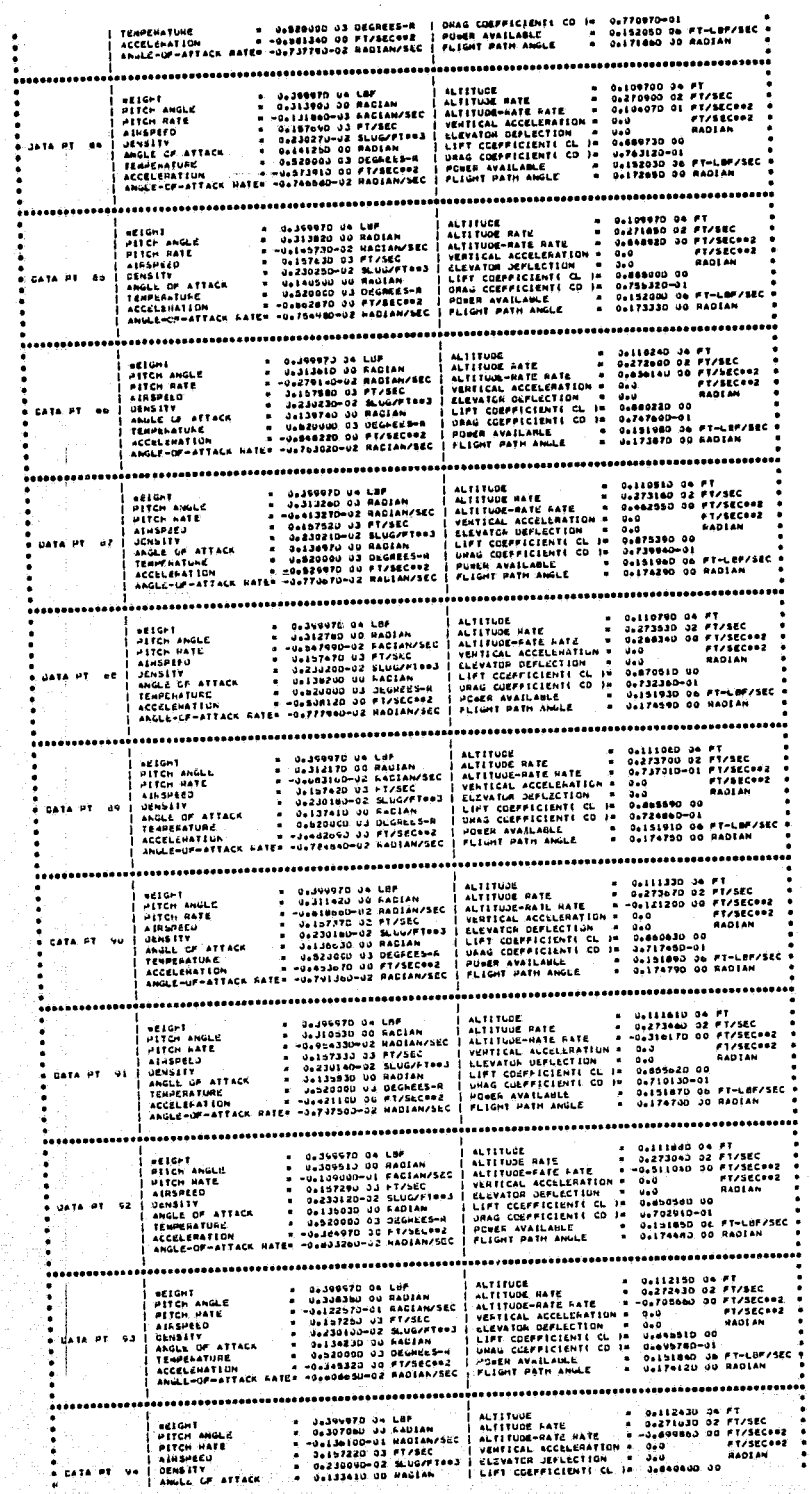


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	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.104310 06 FT	
	PITCH ANGLE	= 0.269340 00 RADIAN	ALTITUDE RATE	= 0.208110 02 FT/SEC	
	PITCH RATE	= 0.240650-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.486700 01 FT/SEC**2	
	AIRSPEED	= 0.188540 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 62	DENSITY	= 0.230660-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.158970 00 RADIAN	LIFT COEFFICIENT(CL)=	0.976210 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.939480-01	
	ACCELERATION	= 0.763890-01 FT/SEC**2	POWER AVAILABLE	= 0.192400 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.679730-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.130370 00 RADIAN	
	WEIGHT	= 0.399680 06 LBF	ALTITUDE	= 0.104520 06 FT	
	PITCH ANGLE	= 0.297710 00 RADIAN	ALTITUDE RATE	= 0.210600 02 FT/SEC	
	PITCH RATE	= 0.232730-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.463690 01 FT/SEC**2	
	AIRSPEED	= 0.158950 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 63	DENSITY	= 0.230020-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.169440 00 RADIAN	LIFT COEFFICIENT(CL)=	0.973160 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.928200-01	
	ACCELERATION	= 0.110006-01 FT/SEC**2	POWER AVAILABLE	= 0.192400 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.693980-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.133230 00 RADIAN	
	WEIGHT	= 0.399520 06 LBF	ALTITUDE	= 0.104730 06 FT	
	PITCH ANGLE	= 0.296000 00 RADIAN	ALTITUDE RATE	= 0.214980 02 FT/SEC	
	PITCH RATE	= 0.226440-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.441690 01 FT/SEC**2	
	AIRSPEED	= 0.158270 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 64	DENSITY	= 0.229010-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.193580 00 RADIAN	LIFT COEFFICIENT(CL)=	0.969960 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.920880-01	
	ACCELERATION	= -0.697360-01 FT/SEC**2	POWER AVAILABLE	= 0.192400 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.698100-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.136020 00 RADIAN	
	WEIGHT	= 0.399080 06 LBF	ALTITUDE	= 0.104930 06 FT	
	PITCH ANGLE	= 0.292200 00 RADIAN	ALTITUDE RATE	= 0.219260 02 FT/SEC	
	PITCH RATE	= 0.215800-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.419310 01 FT/SEC**2	
	AIRSPEED	= 0.158540 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 65	DENSITY	= 0.229090-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.193470 00 RADIAN	LIFT COEFFICIENT(CL)=	0.960740 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.913650-01	
	ACCELERATION	= -0.108170 00 FT/SEC**2	POWER AVAILABLE	= 0.192400 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.622090-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.138730 00 RADIAN	
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.105170 06 FT	
	PITCH ANGLE	= 0.294310 00 RADIAN	ALTITUDE RATE	= 0.223370 02 FT/SEC	
	PITCH RATE	= 0.206810-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.448380 01 FT/SEC**2	
	AIRSPEED	= 0.158920 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 66	DENSITY	= 0.230580-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.192940 00 RADIAN	LIFT COEFFICIENT(CL)=	0.963400 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.908930-01	
	ACCELERATION	= -0.162480 00 FT/SEC**2	POWER AVAILABLE	= 0.192390 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.538940-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.141370 00 RADIAN	
	WEIGHT	= 0.399680 06 LBF	ALTITUDE	= 0.105390 06 FT	
	PITCH ANGLE	= 0.296330 00 RADIAN	ALTITUDE RATE	= 0.227360 02 FT/SEC	
	PITCH RATE	= 0.197480-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.342910 01 FT/SEC**2	
	AIRSPEED	= 0.158800 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 67	DENSITY	= 0.230300-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.192390 00 RADIAN	LIFT COEFFICIENT(CL)=	0.959980 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.898310-01	
	ACCELERATION	= -0.215530 00 FT/SEC**2	POWER AVAILABLE	= 0.192380 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.849080-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.143460 00 RADIAN	
	WEIGHT	= 0.399280 06 LBF	ALTITUDE	= 0.105620 06 FT	
	PITCH ANGLE	= 0.298260 00 RADIAN	ALTITUDE RATE	= 0.231220 02 FT/SEC	
	PITCH RATE	= 0.187820-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.378930 01 FT/SEC**2	
	AIRSPEED	= 0.158480 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 68	DENSITY	= 0.230550-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.191840 00 RADIAN	LIFT COEFFICIENT(CL)=	0.956670 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.890610-01	
	ACCELERATION	= -0.264340 00 FT/SEC**2	POWER AVAILABLE	= 0.192370 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.863280-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.146420 00 RADIAN	
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.135850 06 FT	
	PITCH ANGLE	= 0.300090 00 RADIAN	ALTITUDE RATE	= 0.234940 02 FT/SEC	
	PITCH RATE	= 0.177960-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.354460 01 FT/SEC**2	
	AIRSPEED	= 0.158450 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 69	DENSITY	= 0.230530-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.191270 00 RADIAN	LIFT COEFFICIENT(CL)=	0.952880 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.882840-01	
	ACCELERATION	= -0.309840 00 FT/SEC**2	POWER AVAILABLE	= 0.192360 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.576710-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.148820 00 RADIAN	
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.106090 06 FT	
	PITCH ANGLE	= 0.301820 00 RADIAN	ALTITUDE RATE	= 0.239510 02 FT/SEC	
	PITCH RATE	= 0.167950-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.349920 01 FT/SEC**2	
	AIRSPEED	= 0.158420 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 70	DENSITY	= 0.230310-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.190680 00 RADIAN	LIFT COEFFICIENT(CL)=	0.949200 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.874490-01	
	ACCELERATION	= -0.352040 00 FT/SEC**2	POWER AVAILABLE	= 0.192350 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.590040-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.151130 00 RADIAN	
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.106330 06 FT	
	PITCH ANGLE	= 0.303460 00 RADIAN	ALTITUDE RATE	= 0.241930 02 FT/SEC	
	PITCH RATE	= 0.156960-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.334130 01 FT/SEC**2	
	AIRSPEED	= 0.158380 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 71	DENSITY	= 0.230500-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.190090 00 RADIAN	LIFT COEFFICIENT(CL)=	0.946840 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.867090-01	
	ACCELERATION	= -0.390760 00 FT/SEC**2	POWER AVAILABLE	= 0.192330 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE=	-0.603230-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.153350 00 RADIAN	
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.106870 06 FT	
	PITCH ANGLE	= 0.304980 00 RADIAN	ALTITUDE RATE	= 0.243890 02 FT/SEC	
	PITCH RATE	= 0.146080-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.319280 01 FT/SEC**2	
	AIRSPEED	= 0.158340 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2	
DATA PT 72	DENSITY	= 0.230680-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN	
	ANGLE OF ATTACK	= 0.189680 00 RADIAN	LIFT COEFFICIENT(CL)=	0.941680 00	

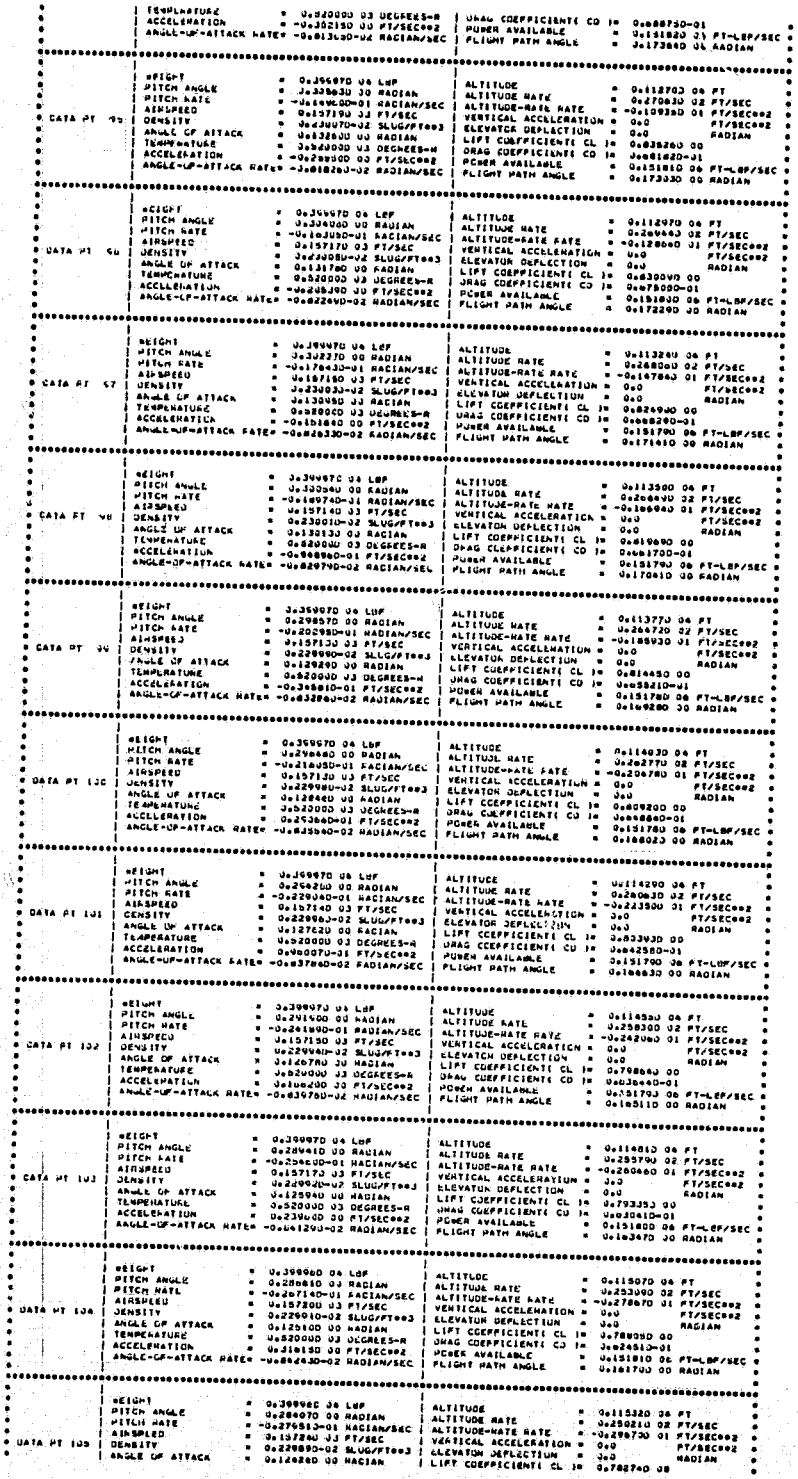
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	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.689140-01	
	ACCELERATION = -0.426090 00 FT/SEC**2	POWER AVAILABLE = 0.192310 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.618380-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.158480 00 RADIAN	
DATA PT 73	WEIGHT = 0.399980 04 LBF PITCH ANGLE = 0.330360 00 RADIAN PITCH RATE = 0.634920-01 RADIAN/SEC AIRSPEED = 0.156330 03 FT/SEC DENSITY = 0.230670-02 SLUG/FT**3 ANGLE OF ATTACK = 0.148880 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.657950 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.621910-02 RADIAN/SEC	ALTITUDE = 0.106820 06 FT ALTITUDE RATE = 0.260290 02 FT/SEC ALTITUDE-RATE RATE = 0.302100 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.937670 00 DRAG COEFFICIENT(CD)= 0.681180-01 POWER AVAILABLE = 0.192270 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.167580 00 RADIAN	
DATA PT 74	WEIGHT = 0.399980 04 LBF PITCH ANGLE = 0.307680 00 RADIAN PITCH RATE = 0.123500-01 RADIAN/SEC AIRSPEED = 0.156250 03 FT/SEC DENSITY = 0.230680-02 SLUG/FT**3 ANGLE OF ATTACK = 0.146220 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.698310 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.641780-02 RADIAN/SEC	ALTITUDE = 0.107070 06 FT ALTITUDE RATE = 0.261230 02 FT/SEC ALTITUDE-RATE RATE = 0.285510 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.933670 00 DRAG COEFFICIENT(CD)= 0.683120-01 POWER AVAILABLE = 0.192270 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.159430 00 RADIAN	
DATA PT 75	WEIGHT = 0.399680 04 LBF PITCH ANGLE = 0.308830 00 RADIAN PITCH RATE = 0.111890-01 RADIAN/SEC AIRSPEED = 0.156800 03 FT/SEC DENSITY = 0.230630-02 SLUG/FT**3 ANGLE OF ATTACK = 0.147570 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.611150 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.653030-02 RADIAN/SEC	ALTITUDE = 0.107320 06 FT ALTITUDE RATE = 0.264000 02 FT/SEC ALTITUDE-RATE RATE = 0.268580 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.929590 00 DRAG COEFFICIENT(CD)= 0.839070-01 POWER AVAILABLE = 0.192250 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.161260 00 RADIAN	
DATA PT 76	WEIGHT = 0.399580 04 LBF PITCH ANGLE = 0.309890 00 RADIAN PITCH RATE = 0.999830-02 RADIAN/SEC AIRSPEED = 0.156190 03 FT/SEC DENSITY = 0.230610-02 SLUG/FT**3 ANGLE OF ATTACK = 0.149910 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = 0.532650 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.668730-02 RADIAN/SEC	ALTITUDE = 0.107580 06 FT ALTITUDE RATE = 0.258600 02 FT/SEC ALTITUDE-RATE RATE = 0.251270 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.925430 00 DRAG COEFFICIENT(CD)= 0.827010-01 POWER AVAILABLE = 0.192230 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.162980 00 RADIAN	
DATA PT 77	WEIGHT = 0.399980 04 LBF PITCH ANGLE = 0.310830 00 RADIAN PITCH RATE = 0.879060-02 RADIAN/SEC AIRSPEED = 0.156090 03 FT/SEC DENSITY = 0.230840-02 SLUG/FT**3 ANGLE OF ATTACK = 0.146240 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.653200 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.667130-02 RADIAN/SEC	ALTITUDE = 0.107840 06 FT ALTITUDE RATE = 0.259030 02 FT/SEC ALTITUDE-RATE RATE = 0.233690 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.921200 00 DRAG COEFFICIENT(CD)= 0.818960-01 POWER AVAILABLE = 0.192200 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.164890 00 RADIAN	
DATA PT 78	WEIGHT = 0.399970 04 LBF PITCH ANGLE = 0.311650 00 RADIAN PITCH RATE = 0.750350-02 RADIAN/SEC AIRSPEED = 0.156040 03 FT/SEC DENSITY = 0.233380-02 SLUG/FT**3 ANGLE OF ATTACK = 0.145860 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.634370 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.668230-02 RADIAN/SEC	ALTITUDE = 0.108100 06 FT ALTITUDE RATE = 0.261270 02 FT/SEC ALTITUDE-RATE RATE = 0.215820 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.916690 00 DRAG COEFFICIENT(CD)= 0.810490-01 POWER AVAILABLE = 0.192180 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.166090 00 RADIAN	
DATA PT 79	WEIGHT = 0.399670 04 LBF PITCH ANGLE = 0.312340 00 RADIAN PITCH RATE = 0.631830-02 RADIAN/SEC AIRSPEED = 0.157980 03 FT/SEC DENSITY = 0.230360-02 SLUG/FT**3 ANGLE OF ATTACK = 0.144880 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.574980 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.668870-02 RADIAN/SEC	ALTITUDE = 0.108360 06 FT ALTITUDE RATE = 0.263340 02 FT/SEC ALTITUDE-RATE RATE = 0.197700 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.912520 00 DRAG COEFFICIENT(CD)= 0.802840-01 POWER AVAILABLE = 0.192160 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.167480 00 RADIAN	
DATA PT 80	WEIGHT = 0.399670 04 LBF PITCH ANGLE = 0.312980 00 RADIAN PITCH RATE = 0.545640-02 RADIAN/SEC AIRSPEED = 0.157920 03 FT/SEC DENSITY = 0.230340-02 SLUG/FT**3 ANGLE OF ATTACK = 0.144860 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.581960 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.670170-02 RADIAN/SEC	ALTITUDE = 0.108820 06 FT ALTITUDE RATE = 0.265230 02 FT/SEC ALTITUDE-RATE RATE = 0.179360 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.908690 00 DRAG COEFFICIENT(CD)= 0.796820-01 POWER AVAILABLE = 0.192130 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.168750 00 RADIAN	
DATA PT 81	WEIGHT = 0.399970 04 LBF PITCH ANGLE = 0.313350 00 RADIAN PITCH RATE = 0.477010-02 RADIAN/SEC AIRSPEED = 0.157800 03 FT/SEC DENSITY = 0.230320-02 SLUG/FT**3 ANGLE OF ATTACK = 0.143650 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.589360 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.671090-02 RADIAN/SEC	ALTITUDE = 0.108890 06 FT ALTITUDE RATE = 0.266030 02 FT/SEC ALTITUDE-RATE RATE = 0.160780 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.903590 00 DRAG COEFFICIENT(CD)= 0.786830-01 POWER AVAILABLE = 0.192100 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.169090 00 RADIAN	
DATA PT 82	WEIGHT = 0.399870 04 LBF PITCH ANGLE = 0.313360 00 RADIAN PITCH RATE = 0.268770-02 RADIAN/SEC AIRSPEED = 0.157800 03 FT/SEC DENSITY = 0.230310-02 SLUG/FT**3 ANGLE OF ATTACK = 0.142720 00 RADIAN TEMPERATURE = 0.520000 03 DEGREES-R ACCELERATION = -0.589160 00 FT/SEC**2 ANGLE-OF-ATTACK RATE= -0.672830-02 RADIAN/SEC	ALTITUDE = 0.109160 06 FT ALTITUDE RATE = 0.266440 02 FT/SEC ALTITUDE-RATE RATE = 0.162030 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.899030 00 DRAG COEFFICIENT(CD)= 0.777870-01 POWER AVAILABLE = 0.192080 06 FT-LBF/SEC FLIGHT PATH ANGLE = 0.170960 00 RADIAN	
DATA PT 83	WEIGHT = 0.399670 04 LBF PITCH ANGLE = 0.313880 00 RADIAN PITCH RATE = 0.118380-02 RADIAN/SEC AIRSPEED = 0.157750 03 FT/SEC DENSITY = 0.230280-02 SLUG/FT**3 ANGLE OF ATTACK = 0.141990 00 RADIAN	ALTITUDE = 0.109630 06 FT ALTITUDE RATE = 0.267770 02 FT/SEC ALTITUDE-RATE RATE = 0.163120 01 FT/SEC**2 VERTICAL ACCELERATION = 0.0 FT/SEC**2 ELEVATOR DEFLECTION = 0.0 RADIAN LIFT COEFFICIENT(CL)= 0.894610 00	


TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.961340 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.737780-02 RADIAN/SEC
DRAG COEFFICIENT CD = 0.770970-01
POWER AVAILABLE = 0.152050 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.171480 00 RADIAN
DATA PT 86
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.313900 00 RADIAN
PITCH RATE = -0.131800-03 RADIAN/SEC
AIRSPEED = 0.157690 03 FT/SEC
DENSITY = 0.823027U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.141250 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.573910 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.746880-02 RADIAN/SEC
ALTITUDE = 0.109700 04 FT
ALTITUDE RATE = 0.270900 02 FT/SEC
ALTITUDE-RATE RATE = 0.104070 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.689730 00
DRAG COEFFICIENT CD = 0.763120-01
POWER AVAILABLE = 0.152030 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.172690 00 RADIAN
DATA PT 87
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.313820 00 RADIAN
PITCH RATE = -0.149730-02 RADIAN/SEC
AIRSPEED = 0.157630 03 FT/SEC
DENSITY = 0.823025U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.141450 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.862870 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.756480-02 RADIAN/SEC
ALTITUDE = 0.109970 04 FT
ALTITUDE RATE = 0.271680 02 FT/SEC
ALTITUDE-RATE RATE = 0.688820 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.688000 00
DRAG COEFFICIENT CD = 0.758320-01
POWER AVAILABLE = 0.152000 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.173330 00 RADIAN
DATA PT 88
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.313810 00 RADIAN
PITCH RATE = -0.279140-02 RADIAN/SEC
AIRSPEED = 0.157580 03 FT/SEC
DENSITY = 0.823023U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.139740 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.868220 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.763020-02 RADIAN/SEC
ALTITUDE = 0.110240 04 FT
ALTITUDE RATE = 0.272680 02 FT/SEC
ALTITUDE-RATE RATE = 0.686140 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.688020 00
DRAG COEFFICIENT CD = 0.767600-01
POWER AVAILABLE = 0.151980 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.173870 00 RADIAN
DATA PT 89
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.313760 00 RADIAN
PITCH RATE = -0.413270-02 RADIAN/SEC
AIRSPEED = 0.157520 03 FT/SEC
DENSITY = 0.823021U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.139690 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.859120 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.771670-02 RADIAN/SEC
ALTITUDE = 0.110510 04 FT
ALTITUDE RATE = 0.273160 02 FT/SEC
ALTITUDE-RATE RATE = 0.684550 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.875390 00
DRAG COEFFICIENT CD = 0.730960-01
POWER AVAILABLE = 0.151960 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174290 00 RADIAN
DATA PT 90
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.313680 00 RADIAN
PITCH RATE = -0.867490-02 RADIAN/SEC
AIRSPEED = 0.157470 03 FT/SEC
DENSITY = 0.823020U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.138200 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.830120 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.777980-02 RADIAN/SEC
ALTITUDE = 0.110790 04 FT
ALTITUDE RATE = 0.273530 02 FT/SEC
ALTITUDE-RATE RATE = 0.680340 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.870510 00
DRAG COEFFICIENT CD = 0.732360-01
POWER AVAILABLE = 0.151930 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174590 00 RADIAN
DATA PT 91
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.312770 00 RADIAN
PITCH RATE = -0.883160-02 RADIAN/SEC
AIRSPEED = 0.157420 03 FT/SEC
DENSITY = 0.823018U-02 SLUG/FT**3
ANGLE OF ATTACH = 0.137810 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.800120 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.784840-02 RADIAN/SEC
ALTITUDE = 0.111060 04 FT
ALTITUDE RATE = 0.273700 02 FT/SEC
ALTITUDE-RATE RATE = 0.737010-01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.865890 00
DRAG COEFFICIENT CD = 0.724880-01
POWER AVAILABLE = 0.151910 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174750 00 RADIAN
DATA PT 92
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.311420 00 RADIAN
PITCH RATE = -0.918080-02 RADIAN/SEC
AIRSPEED = 0.157370 03 FT/SEC
DENSITY = 0.823016U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.136630 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.743670 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.791360-02 RADIAN/SEC
ALTITUDE = 0.111330 04 FT
ALTITUDE RATE = 0.273670 02 FT/SEC
ALTITUDE-RATE RATE = -0.121200 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.860630 00
DRAG COEFFICIENT CD = 0.717650-01
POWER AVAILABLE = 0.151890 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174790 00 RADIAN
DATA PT 93
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.310930 00 RADIAN
PITCH RATE = -0.950e330-02 RADIAN/SEC
AIRSPEED = 0.157330 03 FT/SEC
DENSITY = 0.823014U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.135830 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.e21100 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.797500-02 RADIAN/SEC
ALTITUDE = 0.111681U 04 FT
ALTITUDE RATE = 0.273480 02 FT/SEC
ALTITUDE-RATE RATE = -0.316170 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.855620 00
DRAG COEFFICIENT CD = 0.710130-01
POWER AVAILABLE = 0.151870 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174730 00 RADIAN
DATA PT 94
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.309510 00 RADIAN
PITCH RATE = -0.109000-01 RADIAN/SEC
AIRSPEED = 0.157290 03 FT/SEC
DENSITY = 0.823012U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.135030 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.d49470 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.e83260-02 RADIAN/SEC
ALTITUDE = 0.111d80 04 FT
ALTITUDE RATE = 0.273040 02 FT/SEC
ALTITUDE-RATE RATE = -0.511040 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.850560 00
DRAG COEFFICIENT CD = 0.702910-01
POWER AVAILABLE = 0.151850 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.174680 00 RADIAN
DATA PT 95
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.308380 00 RADIAN
PITCH RATE = -0.e122570-01 RADIAN/SEC
AIRSPEED = 0.157250 03 FT/SEC
DENSITY = 0.823010U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.134830 00 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = -0.d48320 00 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.e86e50-02 RADIAN/SEC
ALTITUDE = 0.112150 04 FT
ALTITUDE RATE = 0.272630 02 FT/SEC
ALTITUDE-RATE RATE = -0.705660 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.e49891U 00
DRAG COEFFICIENT CD = 0.e69780-01
POWER AVAILABLE = 0.151840 06 FT-LBF/SEC
FLIGHT PATH ANGLE = 0.e174120 00 RADIAN
DATA PT 96
WEIGHT = 0.399970 04 LBF
PITCH ANGLE = 0.307080 00 RADIAN
PITCH RATE = -0.e136100-01 RADIAN/SEC
AIRSPEED = 0.157220 03 FT/SEC
DENSITY = 0.823009U-02 SLUG/FT**3
ANGLE OF ATTACK = 0.133610 00 RADIAN
ALTITUDE = 0.112430 04 FT
ALTITUDE RATE = 0.271e30 02 FT/SEC
ALTITUDE-RATE RATE = -0.690860 00 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT CL = 0.8490830 00

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	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.618720-01	
	ACCELERATION = 0.395822D 00 FT/SEC**2	POWER AVAILABLE = 0.151830 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.693190-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.159810 00 RADIAN	
DATA PT 106	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118570 06 FT	
	PITCH ANGLE = 0.281220 00 RADIAN	ALTITUDE RATE = 0.267160 02 FT/SEC	
	PITCH RATE = -0.241670-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.316533 01 FT/SEC**2	
	AIRSPEED = 0.157280 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229870-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.123620 00 RADIAN	LIFT COEFFICIENT(CL)= 0.777630 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.613060-01	
	ACCELERATION = 0.678540 00 FT/SEC**2	POWER AVAILABLE = 0.151850 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.683560-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.157800 00 RADIAN	
DATA PT 107	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118810 06 FT	
	PITCH ANGLE = 0.278240 00 RADIAN	ALTITUDE RATE = 0.263920 02 FT/SEC	
	PITCH RATE = -0.333680-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.332150 01 FT/SEC**2	
	AIRSPEED = 0.157280 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229800-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.122570 00 RADIAN	LIFT COEFFICIENT(CL)= 0.772120 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.607490-01	
	ACCELERATION = 0.670280 00 FT/SEC**2	POWER AVAILABLE = 0.151870 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.683560-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.158870 00 RADIAN	
DATA PT 108	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118080 06 FT	
	PITCH ANGLE = 0.279140 00 RADIAN	ALTITUDE RATE = 0.260820 02 FT/SEC	
	PITCH RATE = -0.319680-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.349850 01 FT/SEC**2	
	AIRSPEED = 0.157390 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229840-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.121730 00 RADIAN	LIFT COEFFICIENT(CL)= 0.768810 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.603090-01	
	ACCELERATION = 0.662610 00 FT/SEC**2	POWER AVAILABLE = 0.151930 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.683140-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.159310 00 RADIAN	
DATA PT 109	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118290 06 FT	
	PITCH ANGLE = 0.279130 00 RADIAN	ALTITUDE RATE = 0.263930 02 FT/SEC	
	PITCH RATE = -0.327010-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.336720 01 FT/SEC**2	
	AIRSPEED = 0.157680 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229820-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.120890 00 RADIAN	LIFT COEFFICIENT(CL)= 0.765330 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.599730-01	
	ACCELERATION = 0.674640 00 FT/SEC**2	POWER AVAILABLE = 0.151930 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.689730-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.158040 00 RADIAN	
DATA PT 110	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118830 06 FT	
	PITCH ANGLE = 0.280680 00 RADIAN	ALTITUDE RATE = 0.233160 02 FT/SEC	
	PITCH RATE = -0.338320-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.362860 01 FT/SEC**2	
	AIRSPEED = 0.157540 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229610-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.120060 00 RADIAN	LIFT COEFFICIENT(CL)= 0.758200 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.594530-01	
	ACCELERATION = 0.636780 00 FT/SEC**2	POWER AVAILABLE = 0.151960 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.691190-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.148860 00 RADIAN	
DATA PT 111	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118780 06 FT	
	PITCH ANGLE = 0.280580 00 RADIAN	ALTITUDE RATE = 0.229260 02 FT/SEC	
	PITCH RATE = -0.336980-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.349030 01 FT/SEC**2	
	AIRSPEED = 0.157630 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229750-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.119280 00 RADIAN	LIFT COEFFICIENT(CL)= 0.750810 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.590640-01	
	ACCELERATION = 0.635480 00 FT/SEC**2	POWER AVAILABLE = 0.152000 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.689960-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.145980 00 RADIAN	
DATA PT 112	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.118090 06 FT	
	PITCH ANGLE = 0.280160 00 RADIAN	ALTITUDE RATE = 0.225180 02 FT/SEC	
	PITCH RATE = -0.335180-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.416730 01 FT/SEC**2	
	AIRSPEED = 0.157730 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229780-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.118360 00 RADIAN	LIFT COEFFICIENT(CL)= 0.769820 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.581670-01	
	ACCELERATION = 0.603390 01 FT/SEC**2	POWER AVAILABLE = 0.152050 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.681770-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.143250 00 RADIAN	
DATA PT 113	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.117210 06 FT	
	PITCH ANGLE = 0.257980 00 RADIAN	ALTITUDE RATE = 0.220930 02 FT/SEC	
	PITCH RATE = -0.337210-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.432870 01 FT/SEC**2	
	AIRSPEED = 0.157860 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229760-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.117530 00 RADIAN	LIFT COEFFICIENT(CL)= 0.740780 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.576020-01	
	ACCELERATION = 0.113790 01 FT/SEC**2	POWER AVAILABLE = 0.152090 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.685370-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.140430 00 RADIAN	
DATA PT 114	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.117630 06 FT	
	PITCH ANGLE = 0.256200 00 RADIAN	ALTITUDE RATE = 0.218520 02 FT/SEC	
	PITCH RATE = -0.340980-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.446780 01 FT/SEC**2	
	AIRSPEED = 0.157980 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229750-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.116960 00 RADIAN	LIFT COEFFICIENT(CL)= 0.738100 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.571870-01	
	ACCELERATION = 0.124280 01 FT/SEC**2	POWER AVAILABLE = 0.152140 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.683270-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.137510 00 RADIAN	
DATA PT 115	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.117060 06 FT	
	PITCH ANGLE = 0.253030 00 RADIAN	ALTITUDE RATE = 0.211190 02 FT/SEC	
	PITCH RATE = -0.339040-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.466320 01 FT/SEC**2	
	AIRSPEED = 0.158090 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229730-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.115860 00 RADIAN	LIFT COEFFICIENT(CL)= 0.729870 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.567240-01	
	ACCELERATION = 0.135010 01 FT/SEC**2	POWER AVAILABLE = 0.152200 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.682980-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.134680 00 RADIAN	
DATA PT 116	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.117050 06 FT	
	PITCH ANGLE = 0.248280 00 RADIAN	ALTITUDE RATE = 0.207230 02 FT/SEC	
	PITCH RATE = -0.340630-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.479810 01 FT/SEC**2	
	AIRSPEED = 0.158230 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229720-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.115030 00 RADIAN	LIFT COEFFICIENT(CL)= 0.726850 00	

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	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.662720-01	
	ACCELERATION	= 0.165570 01 FT/SEC**2	POWER AVAILABLE	= 0.152260 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.626850-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.131350 00	RADIAN
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.118080 06	FT
	PITCH ANGLE	= 0.262330 00 RADIAN	ALTITUDE RATE	= 0.243280 02	FT/SEC
	PITCH RATE	= -0.613020-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.486610 01	FT/SEC**2
	AIRSPEED	= 0.158380 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 117	DENSITY	= 0.229700-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.114210 00 RADIAN	LIFT COEFFICIENT(CL)=	0.719490 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.558310-01	
	ACCELERATION	= 0.157160 01 FT/SEC**2	POWER AVAILABLE	= 0.152230 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.623560-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.128120 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.118260 06	FT
	PITCH ANGLE	= 0.238190 00 RADIAN	ALTITUDE RATE	= 0.197340 02	FT/SEC
	PITCH RATE	= -0.619120-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.509310 01	FT/SEC**2
	AIRSPEED	= 0.158060 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 118	DENSITY	= 0.229490-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.113390 00 RADIAN	LIFT COEFFICIENT(CL)=	0.714280 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.554000-01	
	ACCELERATION	= 0.156570 01 FT/SEC**2	POWER AVAILABLE	= 0.152430 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.620030-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.124830 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.118453 06	FT
	PITCH ANGLE	= 0.233950 00 RADIAN	ALTITUDE RATE	= 0.192180 02	FT/SEC
	PITCH RATE	= -0.617980-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.523710 01	FT/SEC**2
	AIRSPEED	= 0.158710 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 119	DENSITY	= 0.229680-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.114570 00 RADIAN	LIFT COEFFICIENT(CL)=	0.709120 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.549400-01	
	ACCELERATION	= 0.158010 01 FT/SEC**2	POWER AVAILABLE	= 0.152670 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.618360-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.121380 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.118660 06	FT
	PITCH ANGLE	= 0.229030 00 RADIAN	ALTITUDE RATE	= 0.186870 02	FT/SEC
	PITCH RATE	= -0.616370-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.537400 01	FT/SEC**2
	AIRSPEED	= 0.158900 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 120	DENSITY	= 0.229980-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.111790 00 RADIAN	LIFT COEFFICIENT(CL)=	0.703990 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.545690-01	
	ACCELERATION	= 0.142010 01 FT/SEC**2	POWER AVAILABLE	= 0.152550 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.612480-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.117870 00	RADIAN
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.118820 06	FT
	PITCH ANGLE	= 0.225220 00 RADIAN	ALTITUDE RATE	= 0.181420 02	FT/SEC
	PITCH RATE	= -0.614440-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.551570 01	FT/SEC**2
	AIRSPEED	= 0.159100 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 121	DENSITY	= 0.229860-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.110860 00 RADIAN	LIFT COEFFICIENT(CL)=	0.698860 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.541690-01	
	ACCELERATION	= 0.140320 01 FT/SEC**2	POWER AVAILABLE	= 0.152640 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.608320-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.114280 00	RADIAN
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.119030 06	FT
	PITCH ANGLE	= 0.222740 00 RADIAN	ALTITUDE RATE	= 0.175640 02	FT/SEC
	PITCH RATE	= -0.614230-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.565030 01	FT/SEC**2
	AIRSPEED	= 0.159310 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 122	DENSITY	= 0.229840-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.110140 00 RADIAN	LIFT COEFFICIENT(CL)=	0.693810 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.537780-01	
	ACCELERATION	= 0.216210 01 FT/SEC**2	POWER AVAILABLE	= 0.152730 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.603970-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.110800 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.119180 06	FT
	PITCH ANGLE	= 0.216140 00 RADIAN	ALTITUDE RATE	= 0.170120 02	FT/SEC
	PITCH RATE	= -0.659800-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.578170 01	FT/SEC**2
	AIRSPEED	= 0.159930 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 123	DENSITY	= 0.229630-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.109340 00 RADIAN	LIFT COEFFICIENT(CL)=	0.688760 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.533980-01	
	ACCELERATION	= 0.228570 01 FT/SEC**2	POWER AVAILABLE	= 0.152630 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.599600-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.106860 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.119340 06	FT
	PITCH ANGLE	= 0.211550 00 RADIAN	ALTITUDE RATE	= 0.164280 02	FT/SEC
	PITCH RATE	= -0.660940-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.590980 01	FT/SEC**2
	AIRSPEED	= 0.159770 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 124	DENSITY	= 0.229620-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.108540 00 RADIAN	LIFT COEFFICIENT(CL)=	0.683740 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.530260-01	
	ACCELERATION	= 0.241100 01 FT/SEC**2	POWER AVAILABLE	= 0.152930 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.596020-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.103010 00	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.119500 06	FT
	PITCH ANGLE	= 0.206840 00 RADIAN	ALTITUDE RATE	= 0.154300 02	FT/SEC
	PITCH RATE	= -0.673720-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.603460 01	FT/SEC**2
	AIRSPEED	= 0.160910 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 125	DENSITY	= 0.229610-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.107750 00 RADIAN	LIFT COEFFICIENT(CL)=	0.678750 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.526640-01	
	ACCELERATION	= 0.253780 01 FT/SEC**2	POWER AVAILABLE	= 0.153030 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.589620-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.990940-01	RADIAN
	WEIGHT	= 0.399960 06 LBF	ALTITUDE	= 0.119660 06	FT
	PITCH ANGLE	= 0.202407 00 RADIAN	ALTITUDE RATE	= 0.152210 02	FT/SEC
	PITCH RATE	= -0.668150-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.615810 01	FT/SEC**2
	AIRSPEED	= 0.161270 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 126	DENSITY	= 0.229600-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.106960 00 RADIAN	LIFT COEFFICIENT(CL)=	0.673800 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.523110-01	
	ACCELERATION	= 0.268690 01 FT/SEC**2	POWER AVAILABLE	= 0.153140 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.586600-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.951120-01	RADIAN
	WEIGHT	= 0.399980 06 LBF	ALTITUDE	= 0.119810 06	FT
	PITCH ANGLE	= 0.197240 00 RADIAN	ALTITUDE RATE	= 0.163990 02	FT/SEC
	PITCH RATE	= -0.668220-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.627620 01	FT/SEC**2
	AIRSPEED	= 0.160360 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 127	DENSITY	= 0.229590-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.106180 00 RADIAN	LIFT COEFFICIENT(CL)=	0.668870 00	

	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.519860-01	
	ACCELERATION = 0.279950 01 FT/SEC**2	POWER AVAILABLE = 0.183260 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.778073-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.910810-01 RADIAN	
DATA PT 126	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.119983 06 FT	
	PITCH ANGLE = 0.192355 00 RADIAN	ALTITUDE RATE = 0.139680 02 FT/SEC	
	PITCH RATE = -0.491930-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.268880 01 FT/SEC**2	
	AIRSPEED = 0.180430 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229580-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.105400 00 RADIAN	LIFT COEFFICIENT(CL)= 0.663980 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.816310-01	
	ACCELERATION = 0.292630 01 FT/SEC**2	POWER AVAILABLE = 0.193380 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.773320-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.869960-01 RADIAN	
DATA PT 129	WEIGHT = 0.399960 06 LBF	ALTITUDE = 0.120090 06 FT	
	PITCH ANGLE = 0.187400 00 RADIAN	ALTITUDE RATE = 0.133220 02 FT/SEC	
	PITCH RATE = -0.497270-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.690000 01 FT/SEC**2	
	AIRSPEED = 0.181130 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229570-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.104630 00 RADIAN	LIFT COEFFICIENT(CL)= 0.689130 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.813030-01	
	ACCELERATION = 0.308810 01 FT/SEC**2	POWER AVAILABLE = 0.193810 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.767460-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.827700-01 RADIAN	
DATA PT 130	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.120220 06 FT	
	PITCH ANGLE = 0.188400 00 RADIAN	ALTITUDE RATE = 0.128880 02 FT/SEC	
	PITCH RATE = -0.502240-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.680770 01 FT/SEC**2	
	AIRSPEED = 0.181490 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229580-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.103870 00 RADIAN	LIFT COEFFICIENT(CL)= 0.684320 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.809850-01	
	ACCELERATION = 0.319080 01 FT/SEC**2	POWER AVAILABLE = 0.193260 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.761380-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.788370-01 RADIAN	
DATA PT 131	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.120360 06 FT	
	PITCH ANGLE = 0.177360 00 RADIAN	ALTITUDE RATE = 0.120000 02 FT/SEC	
	PITCH RATE = -0.508860-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.671180 01 FT/SEC**2	
	AIRSPEED = 0.181770 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229580-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.103110 00 RADIAN	LIFT COEFFICIENT(CL)= 0.684540 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.806740-01	
	ACCELERATION = 0.332460 01 FT/SEC**2	POWER AVAILABLE = 0.193780 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.755090-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.782930-01 RADIAN	
DATA PT 132	WEIGHT = 0.399960 06 LBF	ALTITUDE = 0.120480 06 FT	
	PITCH ANGLE = 0.172270 00 RADIAN	ALTITUDE RATE = 0.113260 02 FT/SEC	
	PITCH RATE = -0.511360-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.681230 01 FT/SEC**2	
	AIRSPEED = 0.182110 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229560-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.102360 00 RADIAN	LIFT COEFFICIENT(CL)= 0.684810 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.803710-01	
	ACCELERATION = 0.340410 01 FT/SEC**2	POWER AVAILABLE = 0.193920 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.746570-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.699120-01 RADIAN	
DATA PT 133	WEIGHT = 0.399980 06 LBF	ALTITUDE = 0.120570 06 FT	
	PITCH ANGLE = 0.167140 00 RADIAN	ALTITUDE RATE = 0.106360 02 FT/SEC	
	PITCH RATE = -0.514600-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.692910 01 FT/SEC**2	
	AIRSPEED = 0.182460 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229530-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.101610 00 RADIAN	LIFT COEFFICIENT(CL)= 0.684110 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.800760-01	
	ACCELERATION = 0.349230 01 FT/SEC**2	POWER AVAILABLE = 0.194040 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.741880-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.698270-01 RADIAN	
DATA PT 134	WEIGHT = 0.399650 06 LBF	ALTITUDE = 0.120670 06 FT	
	PITCH ANGLE = 0.161970 00 RADIAN	ALTITUDE RATE = 0.996260 01 FT/SEC	
	PITCH RATE = -0.518370-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.700230 01 FT/SEC**2	
	AIRSPEED = 0.182630 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229530-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.100870 00 RADIAN	LIFT COEFFICIENT(CL)= 0.683960 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.797890-01	
	ACCELERATION = 0.357940 01 FT/SEC**2	POWER AVAILABLE = 0.194220 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.735180-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.681090-01 RADIAN	
DATA PT 135	WEIGHT = 0.399950 06 LBF	ALTITUDE = 0.120770 06 FT	
	PITCH ANGLE = 0.156770 00 RADIAN	ALTITUDE RATE = 0.923770 01 FT/SEC	
	PITCH RATE = -0.521480-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.709170 01 FT/SEC**2	
	AIRSPEED = 0.183210 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229520-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.100140 00 RADIAN	LIFT COEFFICIENT(CL)= 0.683085 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.795090-01	
	ACCELERATION = 0.366600 01 FT/SEC**2	POWER AVAILABLE = 0.194370 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.729280-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.680310-01 RADIAN	
DATA PT 136	WEIGHT = 0.399950 06 LBF	ALTITUDE = 0.120860 06 FT	
	PITCH ANGLE = 0.151580 00 RADIAN	ALTITUDE RATE = 0.852420 01 FT/SEC	
	PITCH RATE = -0.526280-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.717780 01 FT/SEC**2	
	AIRSPEED = 0.183300 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229510-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.994170-01 RADIAN	LIFT COEFFICIENT(CL)= 0.682480 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.792370-01	
	ACCELERATION = 0.380230 01 FT/SEC**2	POWER AVAILABLE = 0.194530 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.721620-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.852127D-01 RADIAN	
DATA PT 137	WEIGHT = 0.399950 06 LBF	ALTITUDE = 0.120940 06 FT	
	PITCH ANGLE = 0.146290 00 RADIAN	ALTITUDE RATE = 0.780220 01 FT/SEC	
	PITCH RATE = -0.530630-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.726000 01 FT/SEC**2	
	AIRSPEED = 0.184410 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229510-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.988490-01 RADIAN	LIFT COEFFICIENT(CL)= 0.681780 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.788610-01	
	ACCELERATION = 0.413910 01 FT/SEC**2	POWER AVAILABLE = 0.194700 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.716510-02 RADIAN/SEC	FLIGHT PATH ANGLE = 0.873900-01 RADIAN	
DATA PT 138	WEIGHT = 0.399950 06 LBF	ALTITUDE = 0.121310 06 FT	
	PITCH ANGLE = 0.141010 00 RADIAN	ALTITUDE RATE = 0.707230 01 FT/SEC	
	PITCH RATE = -0.532630-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.733800 01 FT/SEC**2	
	AIRSPEED = 0.184430 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.229500-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.979880-01 RADIAN	LIFT COEFFICIENT(CL)= 0.617290 00	

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	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.487120-01	
	ACCELERATION	= 0.427590 01 FT/SEC**2	POWER AVAILABLE	= 0.156873 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.737580-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.630240-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121080 06	FT
	PITCH ANGLE	= 0.135720 00 RADIAN	ALTITUDE RATE	= 0.633670 01	FT/SEC
	PITCH RATE	= -0.530310-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.741280 01	FT/SEC**2
	AIRSPEED	= 0.104880 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 139	DENSITY	= 0.229500-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.672860-01 RADIAN	LIFT COEFFICIENT(CL)=	0.612850 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.484400-01	
	ACCELERATION	= 0.441270 01 FT/SEC**2	POWER AVAILABLE	= 0.155050 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.730350-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.384340-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121140 06	FT
	PITCH ANGLE	= 0.130610 00 RADIAN	ALTITUDE RATE	= 0.558980 01	FT/SEC
	PITCH RATE	= -0.531650-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.744610 01	FT/SEC**2
	AIRSPEED	= 0.105310 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 140	DENSITY	= 0.229500-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.700870-01 RADIAN	LIFT COEFFICIENT(CL)=	0.608460 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.482150-01	
	ACCELERATION	= 0.434660 01 FT/SEC**2	POWER AVAILABLE	= 0.155230 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.693510-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.338200-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121190 06	FT
	PITCH ANGLE	= 0.125090 00 RADIAN	ALTITUDE RATE	= 0.483860 01	FT/SEC
	PITCH RATE	= -0.532620-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.758140 01	FT/SEC**2
	AIRSPEED	= 0.105770 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 141	DENSITY	= 0.229500-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.658970-01 RADIAN	LIFT COEFFICIENT(CL)=	0.600110 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.476750-01	
	ACCELERATION	= 0.448890 01 FT/SEC**2	POWER AVAILABLE	= 0.155060 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.688610-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.291890-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121240 06	FT
	PITCH ANGLE	= 0.119760 00 RADIAN	ALTITUDE RATE	= 0.407970 01	FT/SEC
	PITCH RATE	= -0.533240-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.761510 01	FT/SEC**2
	AIRSPEED	= 0.106230 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 142	DENSITY	= 0.229490-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.650140-01 RADIAN	LIFT COEFFICIENT(CL)=	0.599810 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.477620-01	
	ACCELERATION	= 0.462200 01 FT/SEC**2	POWER AVAILABLE	= 0.155010 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.679270-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.249420-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121270 06	FT
	PITCH ANGLE	= 0.114420 00 RADIAN	ALTITUDE RATE	= 0.331510 01	FT/SEC
	PITCH RATE	= -0.533520-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.767510 01	FT/SEC**2
	AIRSPEED	= 0.106740 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 143	DENSITY	= 0.229490-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.640530-01 RADIAN	LIFT COEFFICIENT(CL)=	0.598560 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.475140-01	
	ACCELERATION	= 0.449570 01 FT/SEC**2	POWER AVAILABLE	= 0.155080 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.672090-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.198840-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121300 06	FT
	PITCH ANGLE	= 0.109090 00 RADIAN	ALTITUDE RATE	= 0.254660 01	FT/SEC
	PITCH RATE	= -0.533860-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.773140 01	FT/SEC**2
	AIRSPEED	= 0.106720 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 144	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.636700-01 RADIAN	LIFT COEFFICIENT(CL)=	0.597340 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.472930-01	
	ACCELERATION	= 0.509320 01 FT/SEC**2	POWER AVAILABLE	= 0.154900 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.664850-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.152170-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121340 06	FT
	PITCH ANGLE	= 0.103750 00 RADIAN	ALTITUDE RATE	= 0.174000 01	FT/SEC
	PITCH RATE	= -0.533070-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.778390 01	FT/SEC**2
	AIRSPEED	= 0.107700 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 145	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.632080-01 RADIAN	LIFT COEFFICIENT(CL)=	0.596710 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.470770-01	
	ACCELERATION	= 0.522760 01 FT/SEC**2	POWER AVAILABLE	= 0.156200 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.657960-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.129650-01	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121340 06	FT
	PITCH ANGLE	= 0.988270-01 RADIAN	ALTITUDE RATE	= 0.986130 00	FT/SEC
	PITCH RATE	= -0.532350-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.783280 01	FT/SEC**2
	AIRSPEED	= 0.108290 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 146	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.925550-01 RADIAN	LIFT COEFFICIENT(CL)=	0.595060 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.468660-01	
	ACCELERATION	= 0.536140 01 FT/SEC**2	POWER AVAILABLE	= 0.156410 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.650250-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.587180-02	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121360 06	FT
	PITCH ANGLE	= 0.931380-01 RADIAN	ALTITUDE RATE	= 0.202560 00	FT/SEC
	PITCH RATE	= -0.533300-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.787790 01	FT/SEC**2
	AIRSPEED	= 0.108830 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 147	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.919080-01 RADIAN	LIFT COEFFICIENT(CL)=	0.578890 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.466610-01	
	ACCELERATION	= 0.549650 01 FT/SEC**2	POWER AVAILABLE	= 0.156020 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.642890-02 RADIAN/SEC	FLIGHT PATH ANGLE	= 0.119680-02	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121380 06	FT
	PITCH ANGLE	= 0.908330-01 RADIAN	ALTITUDE RATE	= -0.191870 00	FT/SEC
	PITCH RATE	= -0.533650-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.789090 01	FT/SEC**2
	AIRSPEED	= 0.109110 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 148	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.915080-01 RADIAN	LIFT COEFFICIENT(CL)=	0.576970 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.466000-01	
	ACCELERATION	= 0.554070 01 FT/SEC**2	POWER AVAILABLE	= 0.155730 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.638690-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.113660-02	RADIAN
	WEIGHT	= 0.399950 06 LBF	ALTITUDE	= 0.121340 06	FT
	PITCH ANGLE	= 0.889340-01 RADIAN	ALTITUDE RATE	= -0.983770 00	FT/SEC
	PITCH RATE	= -0.529120-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.793850 01	FT/SEC**2
	AIRSPEED	= 0.109670 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 149	DENSITY	= 0.229480-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.909820-01 RADIAN	LIFT COEFFICIENT(CL)=	0.572970 00	

	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.463620-01	
	ACCELERATION = 0.969230 01 FT/SEC**2	POWER AVAILABLE = 0.156960 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.631730-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.670830-02 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121320 04 FT	
	PITCH ANGLE = 0.796720-01 RADIAN	ALTITUDE RATE = -0.177980 01 FT/SEC	
	PITCH RATE = -0.827290-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.797460 01 FT/SEC**2	
	AIRSPEED = 0.170240 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 150	DENSITY = 0.229680-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.903360-01 RADIAN	LIFT COEFFICIENT(CL)= 0.869010 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.461760-01	
	ACCELERATION = 0.582280 01 FT/SEC**2	POWER AVAILABLE = 0.157160 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.624250-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.104830-01 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121300 04 FT	
	PITCH ANGLE = 0.796090-01 RADIAN	ALTITUDE RATE = -0.257880 01 FT/SEC	
	PITCH RATE = -0.828160-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.800850 01 FT/SEC**2	
	AIRSPEED = 0.170830 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 151	DENSITY = 0.229680-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.867040-01 RADIAN	LIFT COEFFICIENT(CL)= 0.868103 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.459820-01	
	ACCELERATION = 0.598220 01 FT/SEC**2	POWER AVAILABLE = 0.157390 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.616720-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.130950-01 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121270 04 FT	
	PITCH ANGLE = 0.693700-01 RADIAN	ALTITUDE RATE = -0.338060 01 FT/SEC	
	PITCH RATE = -0.822690-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.803490 01 FT/SEC**2	
	AIRSPEED = 0.171630 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 152	DENSITY = 0.229680-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.850910-01 RADIAN	LIFT COEFFICIENT(CL)= 0.861240 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.457993-01	
	ACCELERATION = 0.608040 01 FT/SEC**2	POWER AVAILABLE = 0.157610 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.609140-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.107210-01 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121230 04 FT	
	PITCH ANGLE = 0.641560-01 RADIAN	ALTITUDE RATE = -0.418540 01 FT/SEC	
	PITCH RATE = -0.819450-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.805980 01 FT/SEC**2	
	AIRSPEED = 0.172080 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 153	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.836860-01 RADIAN	LIFT COEFFICIENT(CL)= 0.857630 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.456210-01	
	ACCELERATION = 0.620720 01 FT/SEC**2	POWER AVAILABLE = 0.157840 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.601510-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.263290-01 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121190 04 FT	
	PITCH ANGLE = 0.586720-01 RADIAN	ALTITUDE RATE = -0.499240 01 FT/SEC	
	PITCH RATE = -0.816430-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.808030 01 FT/SEC**2	
	AIRSPEED = 0.172680 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 154	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8258880-01 RADIAN	LIFT COEFFICIENT(CL)= 0.853660 00	
	TEMPERATURE = 0.5200GD 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.454670-01	
	ACCELERATION = 0.633280 01 FT/SEC**2	POWER AVAILABLE = 0.158080 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.593890-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.289160-01 RADIAN	

	WEIGHT = 0.399980 04 LBF	ALTITUDE = 0.121130 04 FT	
	PITCH ANGLE = 0.536190-01 RADIAN	ALTITUDE RATE = -0.580130 01 FT/SEC	
	PITCH RATE = -0.813630-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.809750 01 FT/SEC**2	
	AIRSPEED = 0.173310 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 155	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.872950-01 RADIAN	LIFT COEFFICIENT(CL)= 0.849040 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.452780-01	
	ACCELERATION = 0.648680 01 FT/SEC**2	POWER AVAILABLE = 0.158310 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.586300-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.334790-01 RADIAN	

	WEIGHT = 0.399940 04 LBF	ALTITUDE = 0.121070 04 FT	
	PITCH ANGLE = 0.487000-01 RADIAN	ALTITUDE RATE = -0.661180 01 FT/SEC	
	PITCH RATE = -0.810070-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.811190 01 FT/SEC**2	
	AIRSPEED = 0.173070 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 156	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.887180-01 RADIAN	LIFT COEFFICIENT(CL)= 0.846270 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.451130-01	
	ACCELERATION = 0.663890 01 FT/SEC**2	POWER AVAILABLE = 0.158550 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.578770-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.380150-01 RADIAN	

	WEIGHT = 0.399940 04 LBF	ALTITUDE = 0.121090 04 FT	
	PITCH ANGLE = 0.436180-01 RADIAN	ALTITUDE RATE = -0.742340 01 FT/SEC	
	PITCH RATE = -0.806280-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.812070 01 FT/SEC**2	
	AIRSPEED = 0.174630 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 157	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.881460-01 RADIAN	LIFT COEFFICIENT(CL)= 0.842650 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.449520-01	
	ACCELERATION = 0.678980 01 FT/SEC**2	POWER AVAILABLE = 0.158790 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.571280-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.425220-01 RADIAN	

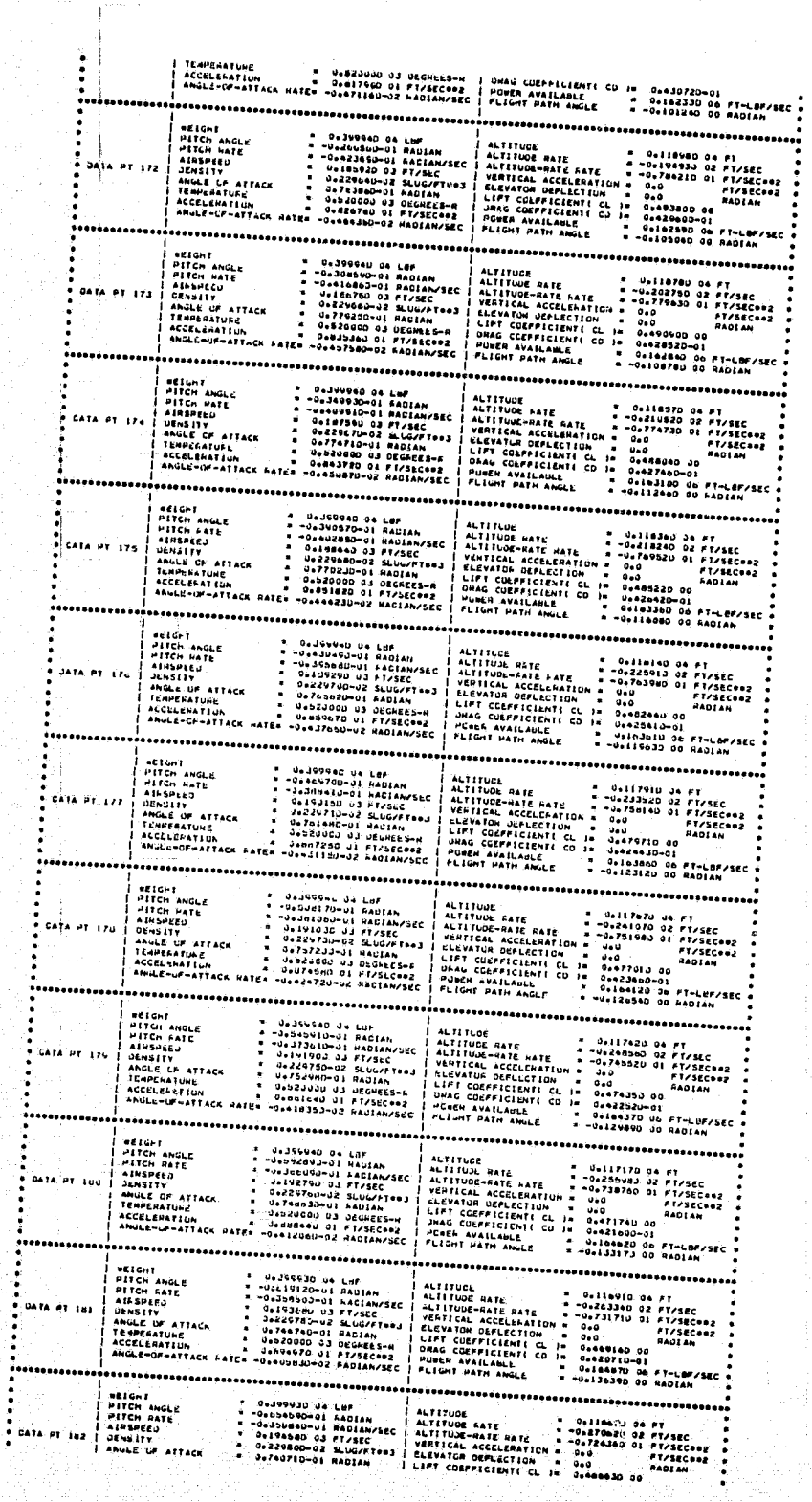
	WEIGHT = 0.399940 04 LBF	ALTITUDE = 0.120920 04 FT	
	PITCH ANGLE = 0.385760-01 RADIAN	ALTITUDE RATE = -0.823560 01 FT/SEC	
	PITCH RATE = -0.802180-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.812680 01 FT/SEC**2	
	AIRSPEED = 0.175310 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 158	DENSITY = 0.229690-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8658730-01 RADIAN	LIFT COEFFICIENT(CL)= 0.839080 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.447980-01	
	ACCELERATION = 0.691850 01 FT/SEC**2	POWER AVAILABLE = 0.159060 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.563830-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.468970-01 RADIAN	

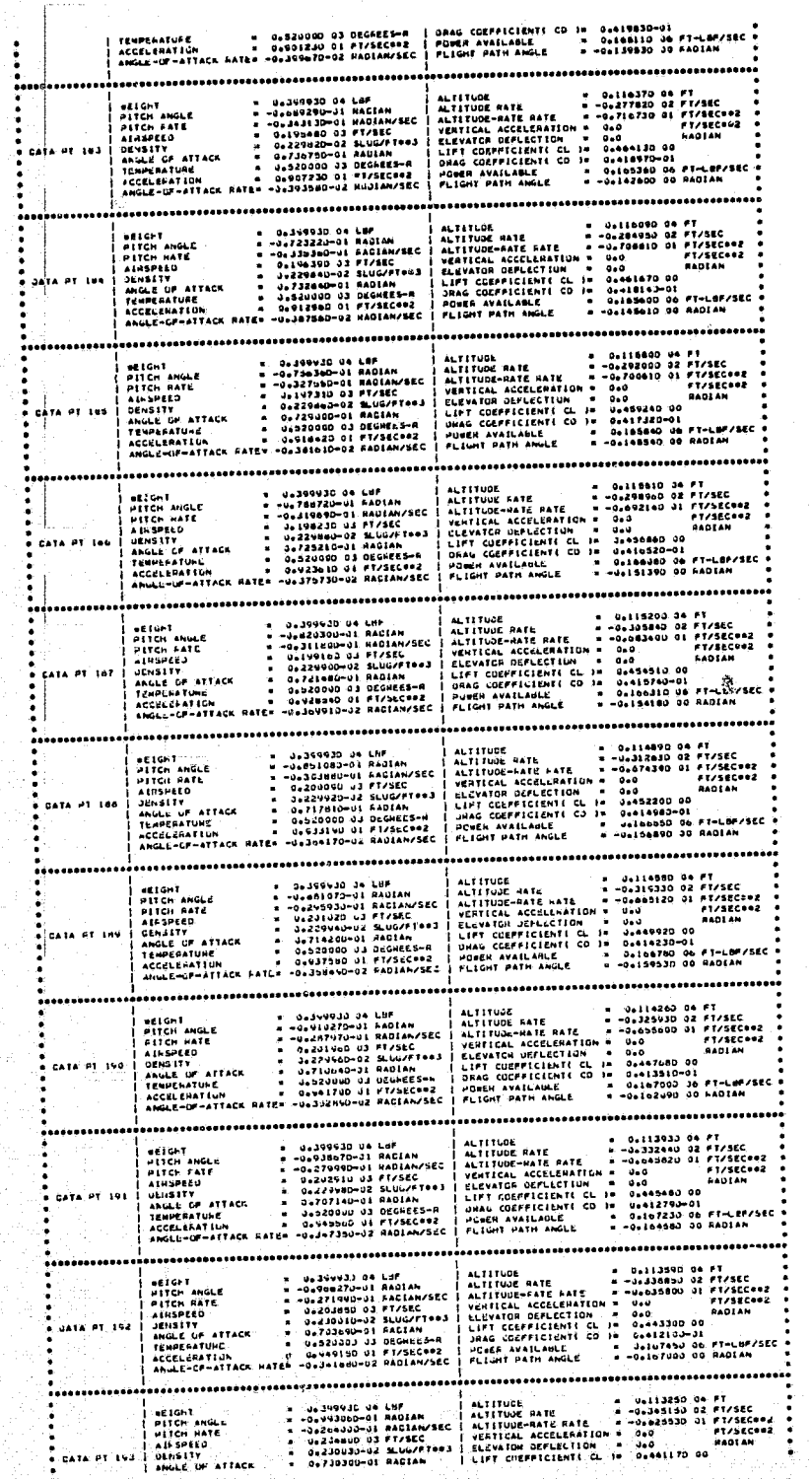
	WEIGHT = 0.399940 04 LBF	ALTITUDE = 0.120840 04 FT	
	PITCH ANGLE = 0.335790-01 RADIAN	ALTITUDE RATE = -0.904680 01 FT/SEC	
	PITCH RATE = -0.797680-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.812930 01 FT/SEC**2	
	AIRSPEED = 0.175980 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 159	DENSITY = 0.229820-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8581130-01 RADIAN	LIFT COEFFICIENT(CL)= 0.838850 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.446420-01	
	ACCELERATION = 0.693360 01 FT/SEC**2	POWER AVAILABLE = 0.159280 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.556430-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.516270-01 RADIAN	

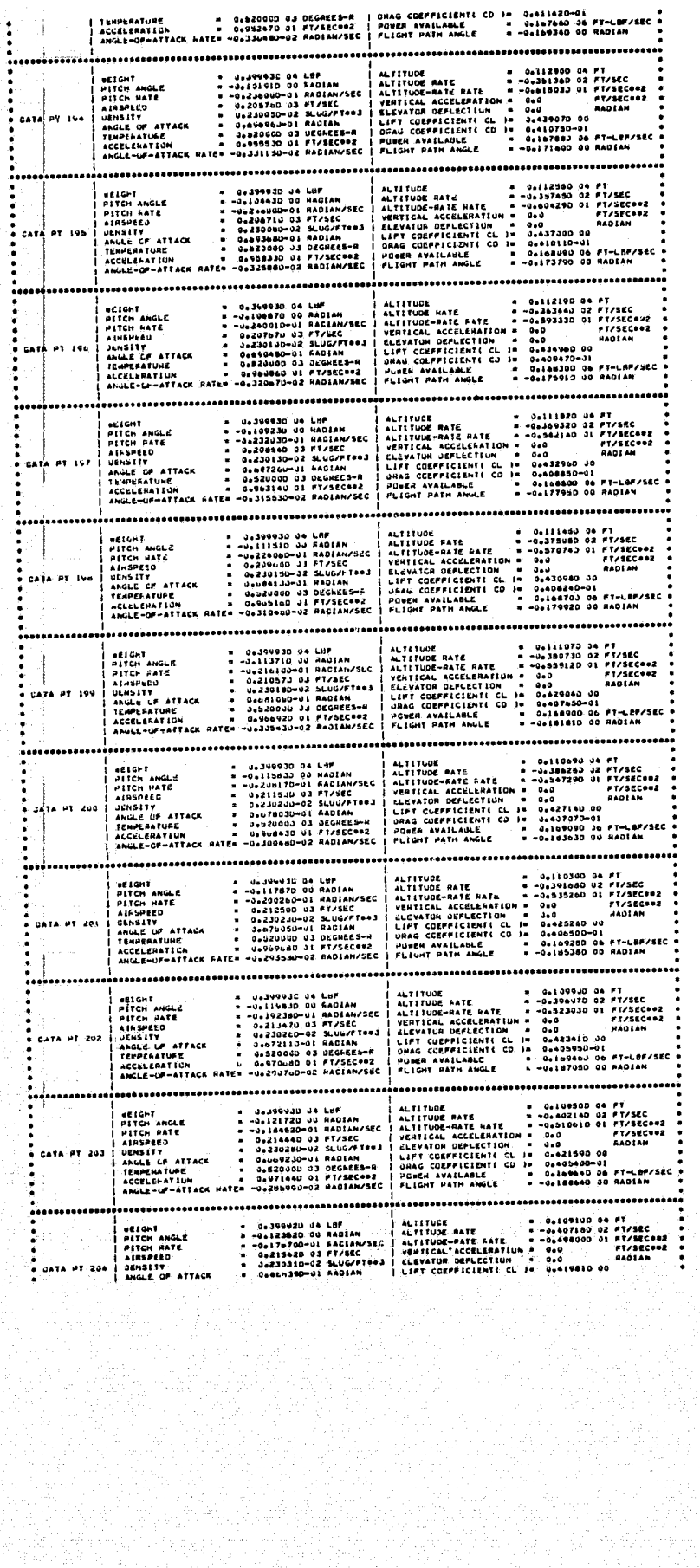
	WEIGHT = 0.399940 04 LBF	ALTITUDE = 0.120760 04 FT	
	PITCH ANGLE = 0.286190-01 RADIAN	ALTITUDE RATE = -0.986190 01 FT/SEC	
	PITCH RATE = -0.793360-01 RADIAN/SEC	ALTITUDE-RATE RATE = -0.812820 01 FT/SEC**2	
	AIRSPEED = 0.176690 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 160	DENSITY = 0.229820-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8644690-01 RADIAN	LIFT COEFFICIENT(CL)= 0.832870 00	

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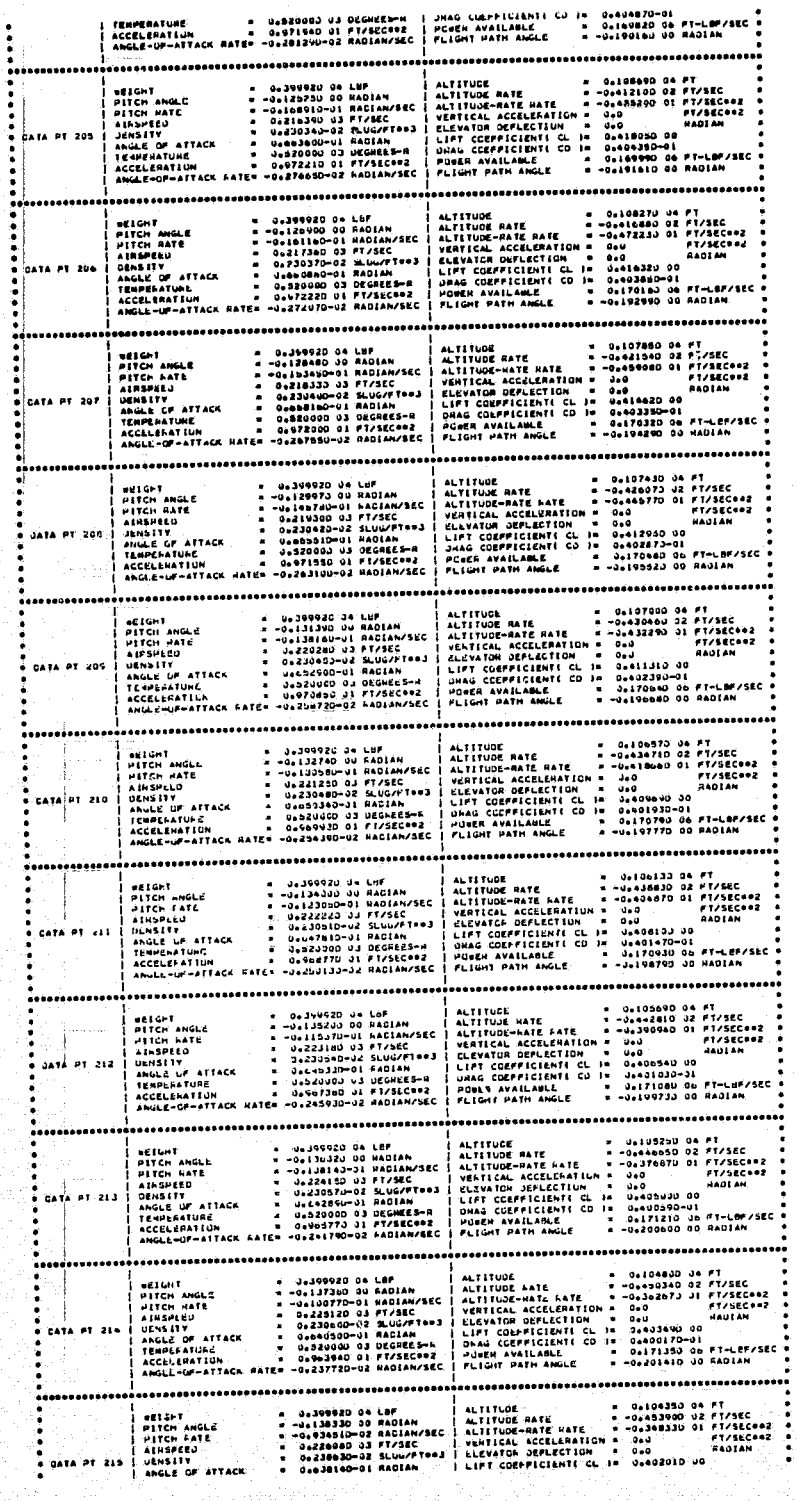
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.464923-01	
	ACCELERATION	= 0.705090 01 FT/SEC**2	POWER AVAILABLE	= 0.169630 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.549080-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.858610-01	RADIAN
DATA PT 101	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120460 06	FT
	PITCH ANGLE	= 0.237090-01 RADIAN	ALTITUDE RATE	= -0.130740 02	FT/SEC
	PITCH RATE	= -0.496570-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.812350 01	FT/SEC**2
	AIRSPEED	= 0.177400 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229530-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.890140-01 RADIAN	LIFT COEFFICIENT(CL)=	0.528630 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.443670-01	
	ACCELERATION	= 0.710420 01 FT/SEC**2	POWER AVAILABLE	= 0.159780 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.561770-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.680250-01	RADIAN
DATA PT 102	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120530 06	FT
	PITCH ANGLE	= 0.188480-01 RADIAN	ALTITUDE RATE	= -0.114460 02	FT/SEC
	PITCH RATE	= -0.643590-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.811520 01	FT/SEC**2
	AIRSPEED	= 0.174130 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229580-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.833780-01 RADIAN	LIFT COEFFICIENT(CL)=	0.525240 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.442350-01	
	ACCELERATION	= 0.727360 01 FT/SEC**2	POWER AVAILABLE	= 0.160330 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.536510-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.668280-01	RADIAN
DATA PT 103	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120410 06	FT
	PITCH ANGLE	= 0.160380-01 RADIAN	ALTITUDE RATE	= -0.122970 02	FT/SEC
	PITCH RATE	= -0.478610-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.810360 01	FT/SEC**2
	AIRSPEED	= 0.174880 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229540-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.828680-01 RADIAN	LIFT COEFFICIENT(CL)=	0.521990 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.440660-01	
	ACCELERATION	= 0.738480 01 FT/SEC**2	POWER AVAILABLE	= 0.160480 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.527290-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.688070-01	RADIAN
DATA PT 104	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120280 06	FT
	PITCH ANGLE	= 0.928100-02 RADIAN	ALTITUDE RATE	= -0.131070 02	FT/SEC
	PITCH RATE	= -0.473020-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.808800 01	FT/SEC**2
	AIRSPEED	= 0.174600 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229590-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.823820-01 RADIAN	LIFT COEFFICIENT(CL)=	0.518600 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.439210-01	
	ACCELERATION	= 0.749200 01 FT/SEC**2	POWER AVAILABLE	= 0.160530 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.520110-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.730410-01	RADIAN
DATA PT 105	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120150 06	FT
	PITCH ANGLE	= 0.457850-02 RADIAN	ALTITUDE RATE	= -0.139150 02	FT/SEC
	PITCH RATE	= -0.467440-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.810690 01	FT/SEC**2
	AIRSPEED	= 0.175360 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229660-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.818050-01 RADIAN	LIFT COEFFICIENT(CL)=	0.515360 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.437990-01	
	ACCELERATION	= 0.759730 01 FT/SEC**2	POWER AVAILABLE	= 0.160790 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.514580-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.772270-01	RADIAN
DATA PT 106	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.120000 06	FT
	PITCH ANGLE	= -0.672430-04 RADIAN	ALTITUDE RATE	= -0.147200 02	FT/SEC
	PITCH RATE	= -0.461040-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.808490 01	FT/SEC**2
	AIRSPEED	= 0.176120 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229670-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.812960-01 RADIAN	LIFT COEFFICIENT(CL)=	0.512130 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.436700-01	
	ACCELERATION	= 0.769980 01 FT/SEC**2	POWER AVAILABLE	= 0.161090 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.509990-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.813630-01	RADIAN
DATA PT 107	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.119950 06	FT
	PITCH ANGLE	= -0.403650-02 RADIAN	ALTITUDE RATE	= -0.155240 02	FT/SEC
	PITCH RATE	= -0.455740-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.802120 01	FT/SEC**2
	AIRSPEED	= 0.181990 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229580-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.807630-01 RADIAN	LIFT COEFFICIENT(CL)=	0.508470 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.435650-01	
	ACCELERATION	= 0.780030 01 FT/SEC**2	POWER AVAILABLE	= 0.161300 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.498500-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.854480-01	RADIAN
DATA PT 108	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.119690 06	FT
	PITCH ANGLE	= -0.918150-02 RADIAN	ALTITUDE RATE	= -0.163250 02	FT/SEC
	PITCH RATE	= -0.449060-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.799210 01	FT/SEC**2
	AIRSPEED	= 0.182000 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229590-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.802930-01 RADIAN	LIFT COEFFICIENT(CL)=	0.505830 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.434220-01	
	ACCELERATION	= 0.799800 01 FT/SEC**2	POWER AVAILABLE	= 0.161560 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.491870-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.894790-01	RADIAN
DATA PT 109	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.119530 06	FT
	PITCH ANGLE	= -0.136470-01 RADIAN	ALTITUDE RATE	= -0.171220 02	FT/SEC
	PITCH RATE	= -0.440370-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.795960 01	FT/SEC**2
	AIRSPEED	= 0.183680 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229600-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.796100-01 RADIAN	LIFT COEFFICIENT(CL)=	0.502770 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.433020-01	
	ACCELERATION	= 0.799460 01 FT/SEC**2	POWER AVAILABLE	= 0.161810 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.484920-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.934560-01	RADIAN
DATA PT 110	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.119350 06	FT
	PITCH ANGLE	= -0.158480-01 RADIAN	ALTITUDE RATE	= -0.179160 02	FT/SEC
	PITCH RATE	= -0.443690-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.792370 01	FT/SEC**2
	AIRSPEED	= 0.184280 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229620-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.793260-01 RADIAN	LIFT COEFFICIENT(CL)=	0.499740 00	
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.431860-01	
	ACCELERATION	= 0.803790 01 FT/SEC**2	POWER AVAILABLE	= 0.162070 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.478020-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.973770-01	RADIAN
DATA PT 111	WEIGHT	= 0.399940 04 LBF	ALTITUDE	= 0.119170 06	FT
	PITCH ANGLE	= -0.223850-01 RADIAN	ALTITUDE RATE	= -0.187070 02	FT/SEC
	PITCH RATE	= -0.430390-01 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.788450 01	FT/SEC**2
	AIRSPEED	= 0.185090 03 FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
	DENSITY	= 0.229630-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.788560-01 RADIAN	LIFT COEFFICIENT(CL)=	0.496750 00	


DATA PT 172
DATA PT 173
DATA PT 174
DATA PT 175
DATA PT 176
DATA PT 177
DATA PT 178
DATA PT 179
DATA PT 180
DATA PT 181
DATA PT 182


TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.901230 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.309670-02 RADIAN/SEC
DRAG COEFFICIENT(CD)= 0.419830-01
POWER AVAILABLE = 0.168110 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.139830 00 RADIAN
DATA PT 183
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.669290-01 RADIAN
PITCH RATE = -0.262130-01 RADIAN/SEC
AIRSPEED = 0.193480 03 FT/SEC
DENSITY = 0.229020-02 SLUG/FT**3
ANGLE OF ATTACK = 0.736750-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.907230 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.393580-02 RADIAN/SEC
ALTITUDE = 0.116370 06 FT
ALTITUDE RATE = -0.277820 02 FT/SEC
ALTITUDE-RATE RATE = -0.716730 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.464130 00
DRAG COEFFICIENT(CD)= 0.418970-01
POWER AVAILABLE = 0.165360 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.142800 00 RADIAN
DATA PT 184
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.723220-01 RADIAN
PITCH RATE = -0.233360-01 RADIAN/SEC
AIRSPEED = 0.194300 03 FT/SEC
DENSITY = 0.229840-02 SLUG/FT**3
ANGLE OF ATTACK = 0.732860-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.912980 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.387580-02 RADIAN/SEC
ALTITUDE = 0.116090 06 FT
ALTITUDE RATE = -0.284950 02 FT/SEC
ALTITUDE-RATE RATE = -0.708810 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.466170 00
DRAG COEFFICIENT(CD)= 0.418163-01
POWER AVAILABLE = 0.165060 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.145610 00 RADIAN
DATA PT 185
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.736360-01 RADIAN
PITCH RATE = -0.327160-01 RADIAN/SEC
AIRSPEED = 0.197310 03 FT/SEC
DENSITY = 0.229460-02 SLUG/FT**3
ANGLE OF ATTACK = 0.729400-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.918620 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.381610-02 RADIAN/SEC
ALTITUDE = 0.115800 06 FT
ALTITUDE RATE = -0.292000 02 FT/SEC
ALTITUDE-RATE RATE = -0.700610 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.469240 00
DRAG COEFFICIENT(CD)= 0.417320-01
POWER AVAILABLE = 0.164860 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.148580 00 RADIAN
DATA PT 186
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = +0.788720-01 RADIAN
PITCH RATE = -0.319690-01 RADIAN/SEC
AIRSPEED = 0.198230 03 FT/SEC
DENSITY = 0.229980-02 SLUG/FT**3
ANGLE OF ATTACK = 0.725210-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.923610 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.375730-02 RADIAN/SEC
ALTITUDE = 0.115510 06 FT
ALTITUDE RATE = -0.298960 02 FT/SEC
ALTITUDE-RATE RATE = -0.692140 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.468860 00
DRAG COEFFICIENT(CD)= 0.416520-01
POWER AVAILABLE = 0.164980 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.151390 00 RADIAN
DATA PT 187
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.820300-01 RADIAN
PITCH RATE = -0.311600-01 RADIAN/SEC
AIRSPEED = 0.199100 03 FT/SEC
DENSITY = 0.229000-02 SLUG/FT**3
ANGLE OF ATTACK = 0.721680-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.928940 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.369910-02 RADIAN/SEC
ALTITUDE = 0.115200 06 FT
ALTITUDE RATE = -0.305840 02 FT/SEC
ALTITUDE-RATE RATE = -0.683400 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.466510 00
DRAG COEFFICIENT(CD)= 0.415740-01
POWER AVAILABLE = 0.164310 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.154180 00 RADIAN
DATA PT 188
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.851080-01 RADIAN
PITCH RATE = -0.330980-01 RADIAN/SEC
AIRSPEED = 0.200090 03 FT/SEC
DENSITY = 0.229920-02 SLUG/FT**3
ANGLE OF ATTACK = 0.717810-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.933190 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.390170-02 RADIAN/SEC
ALTITUDE = 0.114890 06 FT
ALTITUDE RATE = -0.312830 02 FT/SEC
ALTITUDE-RATE RATE = -0.674380 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.465220 00
DRAG COEFFICIENT(CD)= 0.414980-01
POWER AVAILABLE = 0.164055 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.158890 00 RADIAN
DATA PT 189
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.861070-01 RADIAN
PITCH RATE = -0.325930-01 RADIAN/SEC
AIRSPEED = 0.201020 03 FT/SEC
DENSITY = 0.229460-02 SLUG/FT**3
ANGLE OF ATTACK = 0.714200-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.937580 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.358640-02 RADIAN/SEC
ALTITUDE = 0.114680 06 FT
ALTITUDE RATE = -0.315330 02 FT/SEC
ALTITUDE-RATE RATE = -0.668120 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.469920 00
DRAG COEFFICIENT(CD)= 0.414230-01
POWER AVAILABLE = 0.163790 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.162530 00 RADIAN
DATA PT 190
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.910270-01 RADIAN
PITCH RATE = -0.347970-01 RADIAN/SEC
AIRSPEED = 0.201960 03 FT/SEC
DENSITY = 0.229460-02 SLUG/FT**3
ANGLE OF ATTACK = 0.710040-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.941700 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.332490-02 RADIAN/SEC
ALTITUDE = 0.114260 06 FT
ALTITUDE RATE = -0.325930 02 FT/SEC
ALTITUDE-RATE RATE = -0.655600 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.467680 00
DRAG COEFFICIENT(CD)= 0.413510-01
POWER AVAILABLE = 0.167000 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.162490 00 RADIAN
DATA PT 191
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.938670-01 RADIAN
PITCH RATE = -0.279990-01 RADIAN/SEC
AIRSPEED = 0.202910 03 FT/SEC
DENSITY = 0.229980-02 SLUG/FT**3
ANGLE OF ATTACK = 0.707140-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.945560 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.347350-02 RADIAN/SEC
ALTITUDE = 0.113930 06 FT
ALTITUDE RATE = -0.332640 02 FT/SEC
ALTITUDE-RATE RATE = -0.645820 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.465680 00
DRAG COEFFICIENT(CD)= 0.412790-01
POWER AVAILABLE = 0.167230 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.164580 00 RADIAN
DATA PT 192
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.980270-01 RADIAN
PITCH RATE = -0.271490-01 RADIAN/SEC
AIRSPEED = 0.203850 03 FT/SEC
DENSITY = 0.230310-02 SLUG/FT**3
ANGLE OF ATTACK = 0.703690-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.949150 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.341680-02 RADIAN/SEC
ALTITUDE = 0.113590 06 FT
ALTITUDE RATE = -0.338830 02 FT/SEC
ALTITUDE-RATE RATE = -0.635800 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.464330 00
DRAG COEFFICIENT(CD)= 0.412100-01
POWER AVAILABLE = 0.167450 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.167080 00 RADIAN
DATA PT 193
WEIGHT = 0.349930 04 LBF
PITCH ANGLE = -0.993060-01 RADIAN
PITCH RATE = -0.262440-01 RADIAN/SEC
AIRSPEED = 0.204840 03 FT/SEC
DENSITY = 0.230430-02 SLUG/FT**3
ANGLE OF ATTACK = 0.700300-01 RADIAN
ALTITUDE = 0.113250 06 FT
ALTITUDE RATE = -0.343150 02 FT/SEC
ALTITUDE-RATE RATE = -0.625530 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.461170 00


TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.992670 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.330480-02 RADIAN/SEC
DRAG COEFFICIENT(CD)= 0.411620-01
POWER AVAILABLE = 0.167660 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.169360 00 RADIAN
DATA PT 194
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.151910 00 RADIAN
PITCH RATE = -0.249000-01 RADIAN/SEC
AIRSPEED = 0.208760 03 FT/SEC
DENSITY = 0.238050-02 SLUG/FT**3
ANGLE OF ATTACK = 0.690960-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.955530 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.331130-02 RADIAN/SEC
ALTITUDE = 0.112900 04 FT
ALTITUDE RATE = -0.381360 02 FT/SEC
ALTITUDE-RATE RATE = -0.815030 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.439070 00
DRAG COEFFICIENT(CD)= 0.410750-01
POWER AVAILABLE = 0.167880 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.171600 00 RADIAN
DATA PT 195
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.170430 00 RADIAN
PITCH RATE = -0.260010-01 RADIAN/SEC
AIRSPEED = 0.208710 03 FT/SEC
DENSITY = 0.238080-02 SLUG/FT**3
ANGLE OF ATTACK = 0.693680-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.958330 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.325880-02 RADIAN/SEC
ALTITUDE = 0.112580 04 FT
ALTITUDE RATE = -0.357450 02 FT/SEC
ALTITUDE-RATE RATE = -0.806290 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.437300 00
DRAG COEFFICIENT(CD)= 0.410110-01
POWER AVAILABLE = 0.168090 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.173790 00 RADIAN
DATA PT 196
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.170670 00 RADIAN
PITCH RATE = -0.260010-01 RADIAN/SEC
AIRSPEED = 0.207870 03 FT/SEC
DENSITY = 0.238130-02 SLUG/FT**3
ANGLE OF ATTACK = 0.650480-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.990860 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.320670-02 RADIAN/SEC
ALTITUDE = 0.112190 04 FT
ALTITUDE RATE = -0.363640 02 FT/SEC
ALTITUDE-RATE RATE = -0.593330 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.434960 00
DRAG COEFFICIENT(CD)= 0.409670-01
POWER AVAILABLE = 0.168300 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.175910 00 RADIAN
DATA PT 197
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.170920 00 RADIAN
PITCH RATE = -0.232030-01 RADIAN/SEC
AIRSPEED = 0.208860 03 FT/SEC
DENSITY = 0.238130-02 SLUG/FT**3
ANGLE OF ATTACK = 0.687260-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.983140 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.315530-02 RADIAN/SEC
ALTITUDE = 0.111820 04 FT
ALTITUDE RATE = -0.369320 02 FT/SEC
ALTITUDE-RATE RATE = -0.582140 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.432960 00
DRAG COEFFICIENT(CD)= 0.408850-01
POWER AVAILABLE = 0.168880 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.177950 00 RADIAN
DATA PT 198
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.171230 00 RADIAN
PITCH RATE = -0.224060-01 RADIAN/SEC
AIRSPEED = 0.209460 03 FT/SEC
DENSITY = 0.238150-02 SLUG/FT**3
ANGLE OF ATTACK = 0.686160-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.985160 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.310660-02 RADIAN/SEC
ALTITUDE = 0.111460 04 FT
ALTITUDE RATE = -0.375080 02 FT/SEC
ALTITUDE-RATE RATE = -0.570760 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.430980 00
DRAG COEFFICIENT(CD)= 0.408240-01
POWER AVAILABLE = 0.168700 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.179920 00 RADIAN
DATA PT 199
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.171710 00 RADIAN
PITCH RATE = -0.216100-01 RADIAN/SEC
AIRSPEED = 0.210570 03 FT/SEC
DENSITY = 0.238180-02 SLUG/FT**3
ANGLE OF ATTACK = 0.681060-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.986920 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.305630-02 RADIAN/SEC
ALTITUDE = 0.111070 04 FT
ALTITUDE RATE = -0.380730 02 FT/SEC
ALTITUDE-RATE RATE = -0.559120 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.429040 00
DRAG COEFFICIENT(CD)= 0.407650-01
POWER AVAILABLE = 0.168900 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.181810 00 RADIAN
DATA PT 200
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.115630 00 RADIAN
PITCH RATE = -0.208170-01 RADIAN/SEC
AIRSPEED = 0.211530 03 FT/SEC
DENSITY = 0.238200-02 SLUG/FT**3
ANGLE OF ATTACK = 0.678030-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.969830 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.300660-02 RADIAN/SEC
ALTITUDE = 0.110690 04 FT
ALTITUDE RATE = -0.388260 02 FT/SEC
ALTITUDE-RATE RATE = -0.547290 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.427160 00
DRAG COEFFICIENT(CD)= 0.407070-01
POWER AVAILABLE = 0.169090 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.183630 00 RADIAN
DATA PT 201
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.117870 00 RADIAN
PITCH RATE = -0.200260-01 RADIAN/SEC
AIRSPEED = 0.212500 03 FT/SEC
DENSITY = 0.238220-02 SLUG/FT**3
ANGLE OF ATTACK = 0.675050-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.969680 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.295360-02 RADIAN/SEC
ALTITUDE = 0.110300 04 FT
ALTITUDE RATE = -0.391680 02 FT/SEC
ALTITUDE-RATE RATE = -0.535280 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.425280 00
DRAG COEFFICIENT(CD)= 0.406500-01
POWER AVAILABLE = 0.169280 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.185380 00 RADIAN
DATA PT 202
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.119830 00 RADIAN
PITCH RATE = -0.192380-01 RADIAN/SEC
AIRSPEED = 0.213470 03 FT/SEC
DENSITY = 0.238260-02 SLUG/FT**3
ANGLE OF ATTACK = 0.672110-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.970680 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.291760-02 RADIAN/SEC
ALTITUDE = 0.109930 04 FT
ALTITUDE RATE = -0.396470 02 FT/SEC
ALTITUDE-RATE RATE = -0.523030 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.423610 00
DRAG COEFFICIENT(CD)= 0.405950-01
POWER AVAILABLE = 0.169460 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.187050 00 RADIAN
DATA PT 203
WEIGHT = 0.399930 06 LBF
PITCH ANGLE = -0.121720 00 RADIAN
PITCH RATE = -0.184820-01 RADIAN/SEC
AIRSPEED = 0.214440 03 FT/SEC
DENSITY = 0.238280-02 SLUG/FT**3
ANGLE OF ATTACK = 0.669230-01 RADIAN
TEMPERATURE = 0.520000 03 DEGREES-R
ACCELERATION = 0.971660 01 FT/SEC**2
ANGLE-OF-ATTACK RATE= -0.286990-02 RADIAN/SEC
ALTITUDE = 0.109500 04 FT
ALTITUDE RATE = -0.402140 02 FT/SEC
ALTITUDE-RATE RATE = -0.510610 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.421590 00
DRAG COEFFICIENT(CD)= 0.404900-01
POWER AVAILABLE = 0.169640 06 FT-LBF/SEC
FLIGHT PATH ANGLE = -0.188860 00 RADIAN
DATA PT 204
WEIGHT = 0.399920 06 LBF
PITCH ANGLE = -0.123620 00 RADIAN
PITCH RATE = -0.167900-01 RADIAN/SEC
AIRSPEED = 0.215420 03 FT/SEC
DENSITY = 0.238310-02 SLUG/FT**3
ANGLE OF ATTACK = 0.664360-01 RADIAN
ALTITUDE = 0.109100 04 FT
ALTITUDE RATE = -0.407180 02 FT/SEC
ALTITUDE-RATE RATE = -0.498000 01 FT/SEC**2
VERTICAL ACCELERATION = 0.0 FT/SEC**2
ELEVATOR DEFLECTION = 0.0 RADIAN
LIFT COEFFICIENT(CL)= 0.419810 00

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	TEMPERATURE = 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.399750-01	
	ACCELERATION = 0.661890 01 FT/SEC**2	POWER AVAILABLE = 0.171680 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.233690-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.202150 00 RADIAN	

DATA PT 216

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.103890 06 FT
PITCH ANGLE	= -0.139230 00 RADIAN	ALTITUDE RATE	= -0.457310 02 FT/SEC
PITCH RATE	= -0.661870-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.333670 01 FT/SEC**2
AIRSPEED	= 0.227840 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230690-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.635820-01 RADIAN	LIFT COEFFICIENT(CL)=	0.400850 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.399360-01
ACCELERATION	= 0.699620 01 FT/SEC**2	POWER AVAILABLE	= 0.171600 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.229720-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.202810 00 RADIAN

DATA PT 217

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.103830 06 FT
PITCH ANGLE	= -0.140060 00 RADIAN	ALTITUDE RATE	= -0.460980 02 FT/SEC
PITCH RATE	= -0.749810-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.319290 01 FT/SEC**2
AIRSPEED	= 0.228000 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230700-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.633860-01 RADIAN	LIFT COEFFICIENT(CL)=	0.398110 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.398940-01
ACCELERATION	= 0.697160 01 FT/SEC**2	POWER AVAILABLE	= 0.171720 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.225790-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.203410 00 RADIAN

DATA PT 218

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.102970 06 FT
PITCH ANGLE	= -0.140810 00 RADIAN	ALTITUDE RATE	= -0.466370 02 FT/SEC
PITCH RATE	= -0.716330-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.306603 01 FT/SEC**2
AIRSPEED	= 0.228950 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230730-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.633110-01 RADIAN	LIFT COEFFICIENT(CL)=	0.397750 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.398850-01
ACCELERATION	= 0.694440 01 FT/SEC**2	POWER AVAILABLE	= 0.171860 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.221920-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.203960 00 RADIAN

DATA PT 219

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.102590 06 FT
PITCH ANGLE	= -0.141490 00 RADIAN	ALTITUDE RATE	= -0.468870 02 FT/SEC
PITCH RATE	= -0.667460-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.291880 01 FT/SEC**2
AIRSPEED	= 0.229010 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230760-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.629110-01 RADIAN	LIFT COEFFICIENT(CL)=	0.396320 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.398170-01
ACCELERATION	= 0.691540 01 FT/SEC**2	POWER AVAILABLE	= 0.171950 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.218090-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.204400 00 RADIAN

DATA PT 220

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.102240 06 FT
PITCH ANGLE	= -0.142130 00 RADIAN	ALTITUDE RATE	= -0.469490 02 FT/SEC
PITCH RATE	= -0.677150-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.276890 01 FT/SEC**2
AIRSPEED	= 0.230080 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230790-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.626840-01 RADIAN	LIFT COEFFICIENT(CL)=	0.394980 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.397800-01
ACCELERATION	= 0.696630 01 FT/SEC**2	POWER AVAILABLE	= 0.172050 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.216310-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.204800 00 RADIAN

DATA PT 221

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.101570 06 FT
PITCH ANGLE	= -0.142630 00 RADIAN	ALTITUDE RATE	= -0.472170 02 FT/SEC
PITCH RATE	= -0.687670-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.259890 01 FT/SEC**2
AIRSPEED	= 0.231800 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230820-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.622820-01 RADIAN	LIFT COEFFICIENT(CL)=	0.393620 00
TEMPERATURE	= 0.522000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.397630-01
ACCELERATION	= 0.698120 01 FT/SEC**2	POWER AVAILABLE	= 0.172140 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.210580-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.205130 00 RADIAN

DATA PT 222

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.101390 06 FT
PITCH ANGLE	= -0.143120 00 RADIAN	ALTITUDE RATE	= -0.474690 02 FT/SEC
PITCH RATE	= -0.638620-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.246790 01 FT/SEC**2
AIRSPEED	= 0.232750 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230850-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.622730-01 RADIAN	LIFT COEFFICIENT(CL)=	0.392300 00
TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.397080-01
ACCELERATION	= 0.696810 01 FT/SEC**2	POWER AVAILABLE	= 0.172250 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.204910-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.205340 00 RADIAN

DATA PT 223

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.100620 06 FT
PITCH ANGLE	= -0.143520 00 RADIAN	ALTITUDE RATE	= -0.477000 02 FT/SEC
PITCH RATE	= -0.637000-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.229810 01 FT/SEC**2
AIRSPEED	= 0.233690 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230890-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.622540-01 RADIAN	LIFT COEFFICIENT(CL)=	0.391010 00
TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.396730-01
ACCELERATION	= 0.693000 01 FT/SEC**2	POWER AVAILABLE	= 0.172350 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.200390-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.205590 00 RADIAN

DATA PT 224

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.100160 06 FT
PITCH ANGLE	= -0.143860 00 RADIAN	ALTITUDE RATE	= -0.479260 02 FT/SEC
PITCH RATE	= -0.632720-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.216340 01 FT/SEC**2
AIRSPEED	= 0.234620 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230930-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.621870-01 RADIAN	LIFT COEFFICIENT(CL)=	0.390760 00
TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.396390-01
ACCELERATION	= 0.693990 01 FT/SEC**2	POWER AVAILABLE	= 0.172440 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.196090-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.205730 00 RADIAN

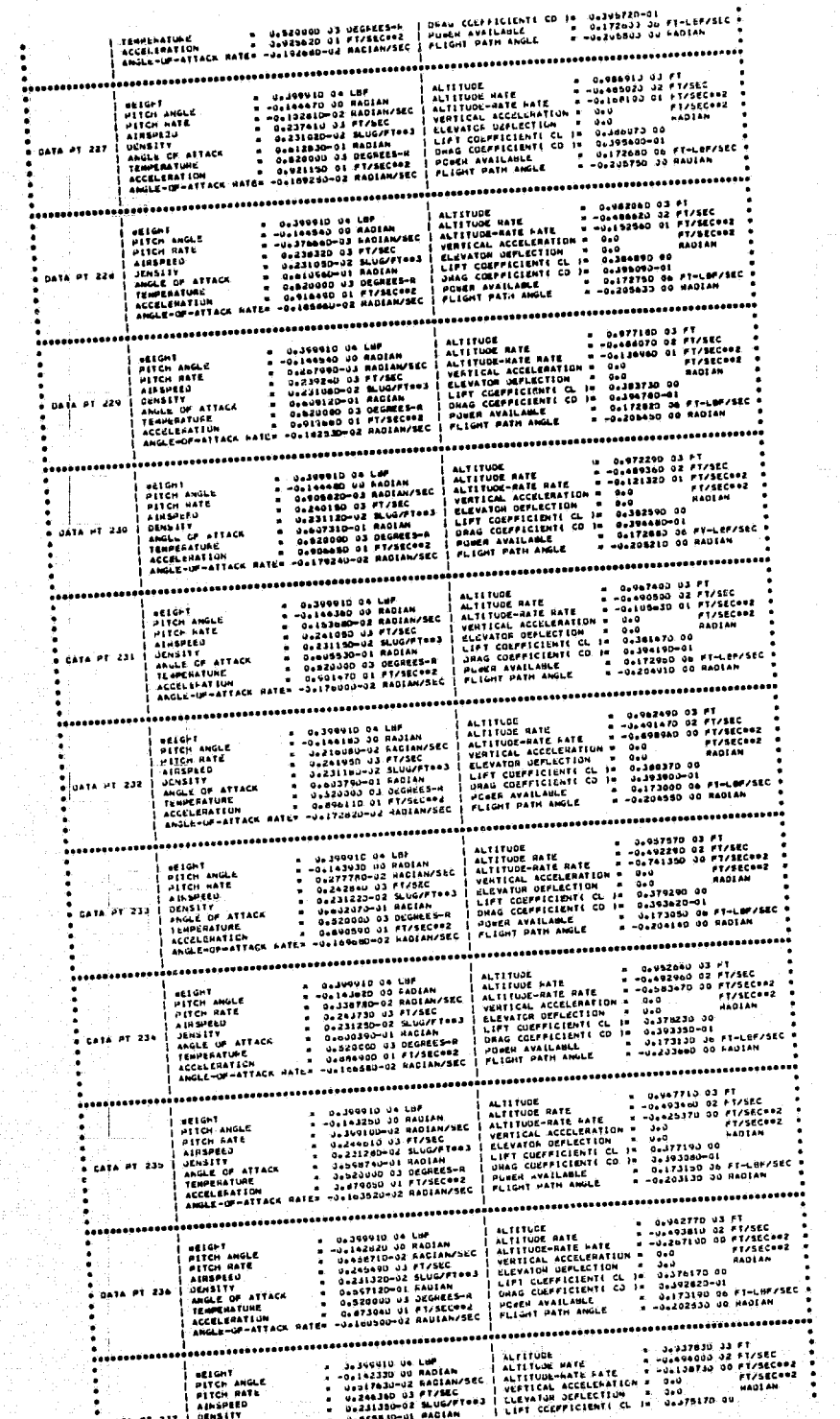
DATA PT 225

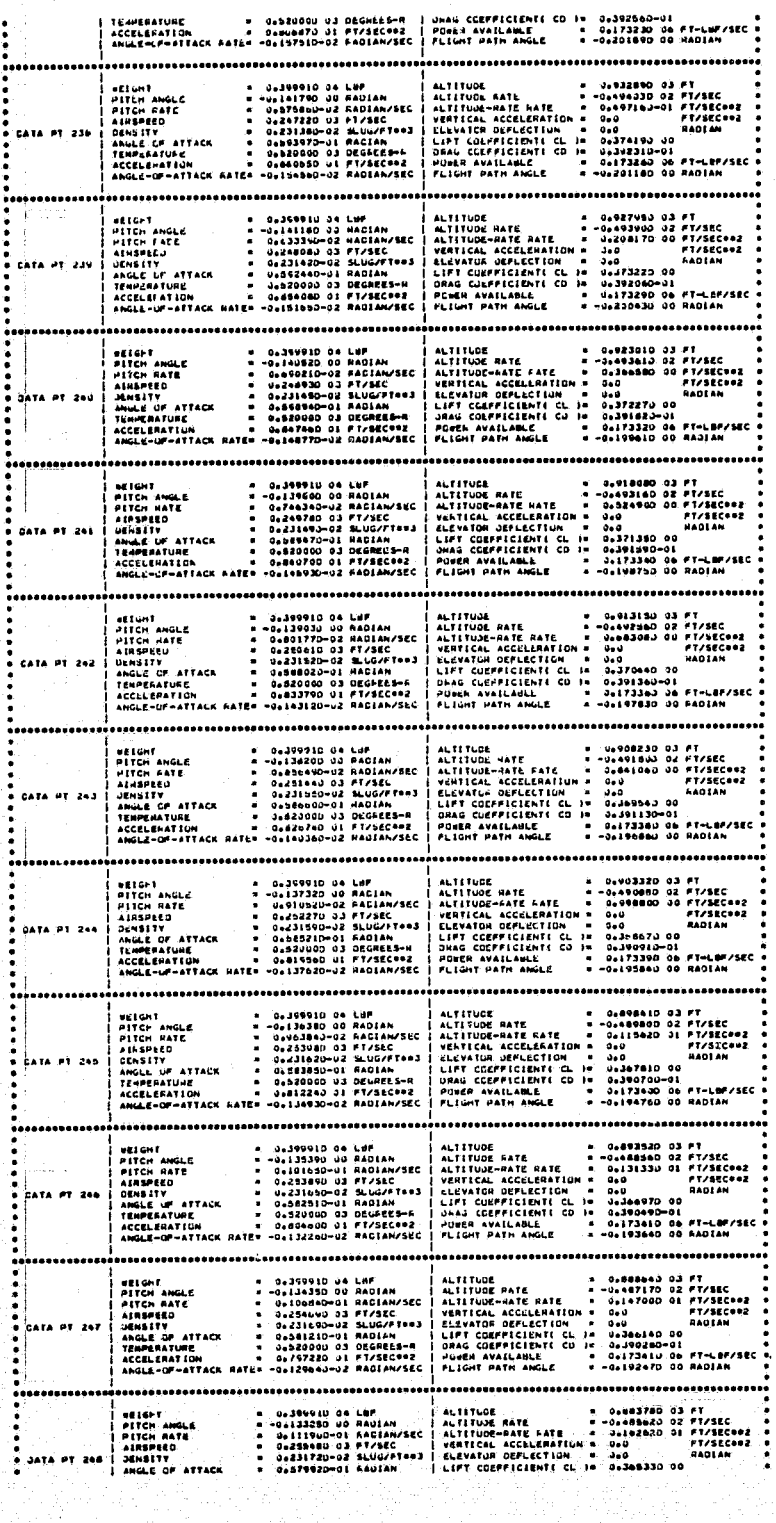
WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.099650 05 FT
PITCH ANGLE	= -0.144130 00 RADIAN	ALTITUDE RATE	= -0.481350 02 FT/SEC
PITCH RATE	= -0.625090-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.195000 01 FT/SEC**2
AIRSPEED	= 0.235950 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230950-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.618690-01 RADIAN	LIFT COEFFICIENT(CL)=	0.388690 00
TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.396020-01
ACCELERATION	= 0.694990 01 FT/SEC**2	POWER AVAILABLE	= 0.172620 06 FT-LBF/SEC
ANGLE-OF-ATTACK RATE=	-0.191610-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.205900 00 RADIAN

DATA PT 226

WEIGHT	= 0.399920 06 LBF	ALTITUDE	= 0.099170 05 FT
PITCH ANGLE	= -0.144330 00 RADIAN	ALTITUDE RATE	= -0.483320 02 FT/SEC
PITCH RATE	= -0.618620-02 RADIAN/SEC	ALTITUDE-RATE RATE	= -0.163580 01 FT/SEC**2
AIRSPEED	= 0.236460 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
DENSITY	= 0.230980-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
ANGLE OF ATTACK	= 0.614760-01 RADIAN	LIFT COEFFICIENT(CL)=	0.387270 00

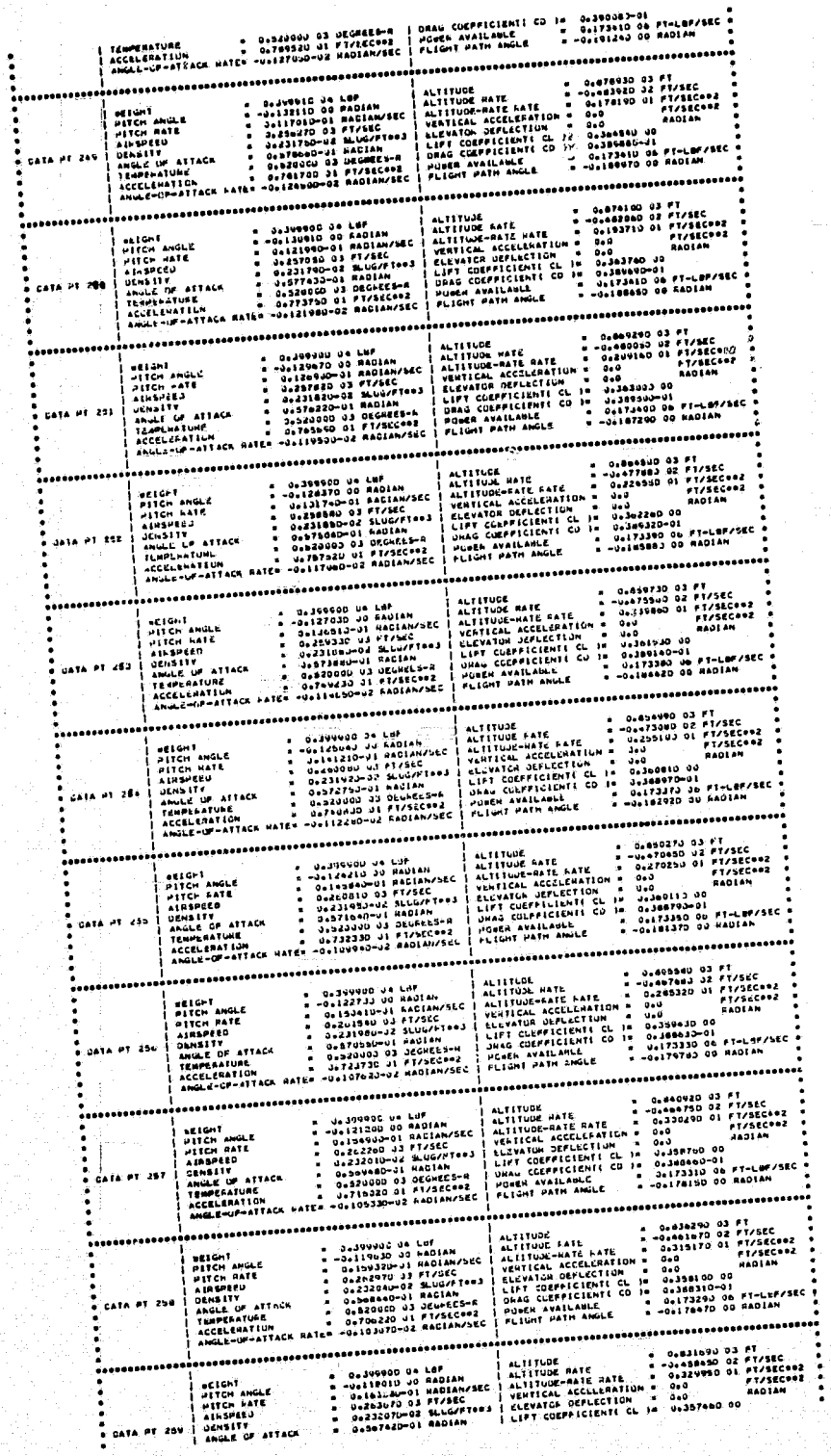
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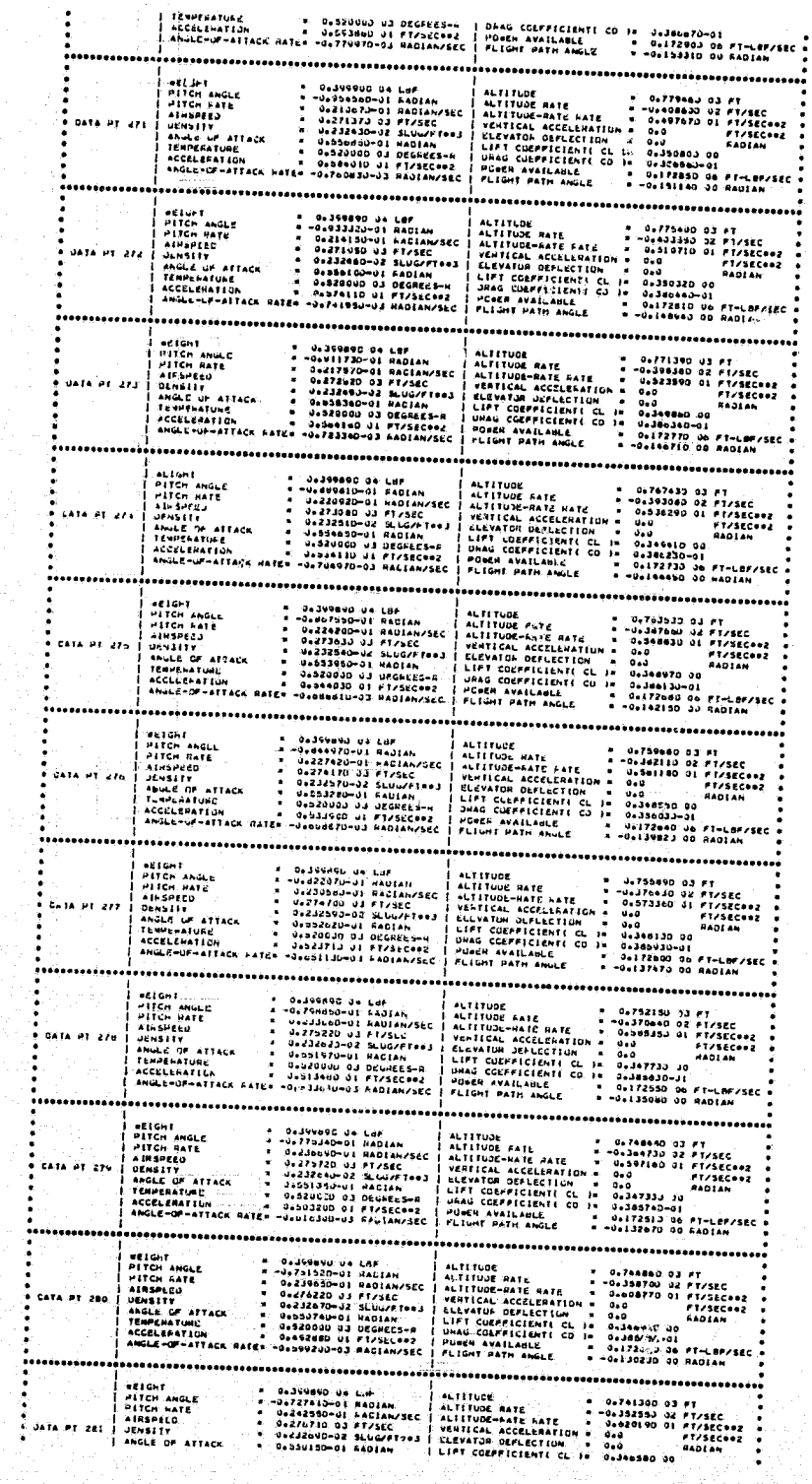
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.392560-01
	ACCELERATION	= 0.000670 01 FT/SEC**2	POWER AVAILABLE	= 0.173230 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.197510-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.201890 00 RADIAN
DATA PT 230	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.932890 03 FT
	PITCH ANGLE	= -0.161790 00 RADIAN	ALTITUDE RATE	= -0.494030 02 FT/SEC
	PITCH RATE	= 0.875800-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.497160-01 FT/SEC**2
	AIRSPEED	= 0.267220 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231380-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.893070-01 RADIAN	LIFT COEFFICIENT(CL)=	0.374190 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.392310-01
	ACCELERATION	= 0.660850 01 FT/SEC**2	POWER AVAILABLE	= 0.173260 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.194880-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.201180 00 RADIAN
DATA PT 231	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.927980 03 FT
	PITCH ANGLE	= -0.161180 00 RADIAN	ALTITUDE RATE	= -0.493900 02 FT/SEC
	PITCH RATE	= 0.633340-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.208170 00 FT/SEC**2
	AIRSPEED	= 0.268080 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231420-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.852460-01 RADIAN	LIFT COEFFICIENT(CL)=	0.373220 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.392060-01
	ACCELERATION	= 0.654080 01 FT/SEC**2	POWER AVAILABLE	= 0.173290 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.191950-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.220830 00 RADIAN
DATA PT 232	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.923010 03 FT
	PITCH ANGLE	= -0.140820 00 RADIAN	ALTITUDE RATE	= -0.493610 02 FT/SEC
	PITCH RATE	= 0.690210-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.306880 00 FT/SEC**2
	AIRSPEED	= 0.268930 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231490-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.860940-01 RADIAN	LIFT COEFFICIENT(CL)=	0.372270 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.391820-01
	ACCELERATION	= 0.667660 01 FT/SEC**2	POWER AVAILABLE	= 0.173320 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.168770-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.199610 00 RADIAN
DATA PT 233	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.918080 03 FT
	PITCH ANGLE	= -0.139680 00 RADIAN	ALTITUDE RATE	= -0.493160 02 FT/SEC
	PITCH RATE	= 0.746360-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.524900 00 FT/SEC**2
	AIRSPEED	= 0.269780 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231490-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.868670-01 RADIAN	LIFT COEFFICIENT(CL)=	0.371380 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.391590-01
	ACCELERATION	= 0.680700 01 FT/SEC**2	POWER AVAILABLE	= 0.173360 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.148930-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.198750 00 RADIAN
DATA PT 234	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.913130 03 FT
	PITCH ANGLE	= -0.139030 00 RADIAN	ALTITUDE RATE	= -0.492980 02 FT/SEC
	PITCH RATE	= 0.801770-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.683080 00 FT/SEC**2
	AIRSPEED	= 0.270610 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231520-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.888020-01 RADIAN	LIFT COEFFICIENT(CL)=	0.370640 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.391360-01
	ACCELERATION	= 0.693790 01 FT/SEC**2	POWER AVAILABLE	= 0.173303 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.143120-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.197830 00 RADIAN
DATA PT 235	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.908230 03 FT
	PITCH ANGLE	= -0.138200 00 RADIAN	ALTITUDE RATE	= -0.491840 02 FT/SEC
	PITCH RATE	= 0.850490-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.861060 00 FT/SEC**2
	AIRSPEED	= 0.271640 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231550-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.906000-01 RADIAN	LIFT COEFFICIENT(CL)=	0.369560 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.391130-01
	ACCELERATION	= 0.682760 01 FT/SEC**2	POWER AVAILABLE	= 0.173380 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.140380-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.196880 00 RADIAN
DATA PT 236	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.903320 03 FT
	PITCH ANGLE	= -0.137320 00 RADIAN	ALTITUDE RATE	= -0.490080 02 FT/SEC
	PITCH RATE	= 0.910520-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.908800 00 FT/SEC**2
	AIRSPEED	= 0.272270 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231590-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.915210-01 RADIAN	LIFT COEFFICIENT(CL)=	0.368670 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.390910-01
	ACCELERATION	= 0.681560 01 FT/SEC**2	POWER AVAILABLE	= 0.173390 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.137620-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.195880 00 RADIAN
DATA PT 237	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.898410 03 FT
	PITCH ANGLE	= -0.136380 00 RADIAN	ALTITUDE RATE	= -0.489800 02 FT/SEC
	PITCH RATE	= 0.963840-02 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.911520 01 FT/SEC**2
	AIRSPEED	= 0.273080 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231620-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.938350-01 RADIAN	LIFT COEFFICIENT(CL)=	0.367810 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.390700-01
	ACCELERATION	= 0.812260 01 FT/SEC**2	POWER AVAILABLE	= 0.173430 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.134930-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.194760 00 RADIAN
DATA PT 238	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.893520 03 FT
	PITCH ANGLE	= -0.135390 00 RADIAN	ALTITUDE RATE	= -0.488560 02 FT/SEC
	PITCH RATE	= 0.101650-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.131330 01 FT/SEC**2
	AIRSPEED	= 0.273890 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231650-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.952310-01 RADIAN	LIFT COEFFICIENT(CL)=	0.366970 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.390490-01
	ACCELERATION	= 0.804600 01 FT/SEC**2	POWER AVAILABLE	= 0.173610 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.132260-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.193660 00 RADIAN
DATA PT 239	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.888643 03 FT
	PITCH ANGLE	= -0.134350 00 RADIAN	ALTITUDE RATE	= -0.487170 02 FT/SEC
	PITCH RATE	= 0.109840-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.147000 01 FT/SEC**2
	AIRSPEED	= 0.274490 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231690-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.961210-01 RADIAN	LIFT COEFFICIENT(CL)=	0.366140 00
	TEMPERATURE	= 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)=	0.390280-01
	ACCELERATION	= 0.797220 01 FT/SEC**2	POWER AVAILABLE	= 0.173610 06 FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.129640-02 RADIAN/SEC	FLIGHT PATH ANGLE	= -0.192670 00 RADIAN
DATA PT 240	WEIGHT	= 0.399910 06 LBF	ALTITUDE	= 0.883780 03 FT
	PITCH ANGLE	= -0.133280 00 RADIAN	ALTITUDE RATE	= -0.485820 02 FT/SEC
	PITCH RATE	= 0.111900-01 RADIAN/SEC	ALTITUDE-RATE RATE	= 0.162820 01 FT/SEC**2
	AIRSPEED	= 0.275480 03 FT/SEC	VERTICAL ACCELERATION	= 0.0 FT/SEC**2
	DENSITY	= 0.231720-02 SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0 RADIAN
	ANGLE OF ATTACK	= 0.979820-01 RADIAN	LIFT COEFFICIENT(CL)=	0.365330 00

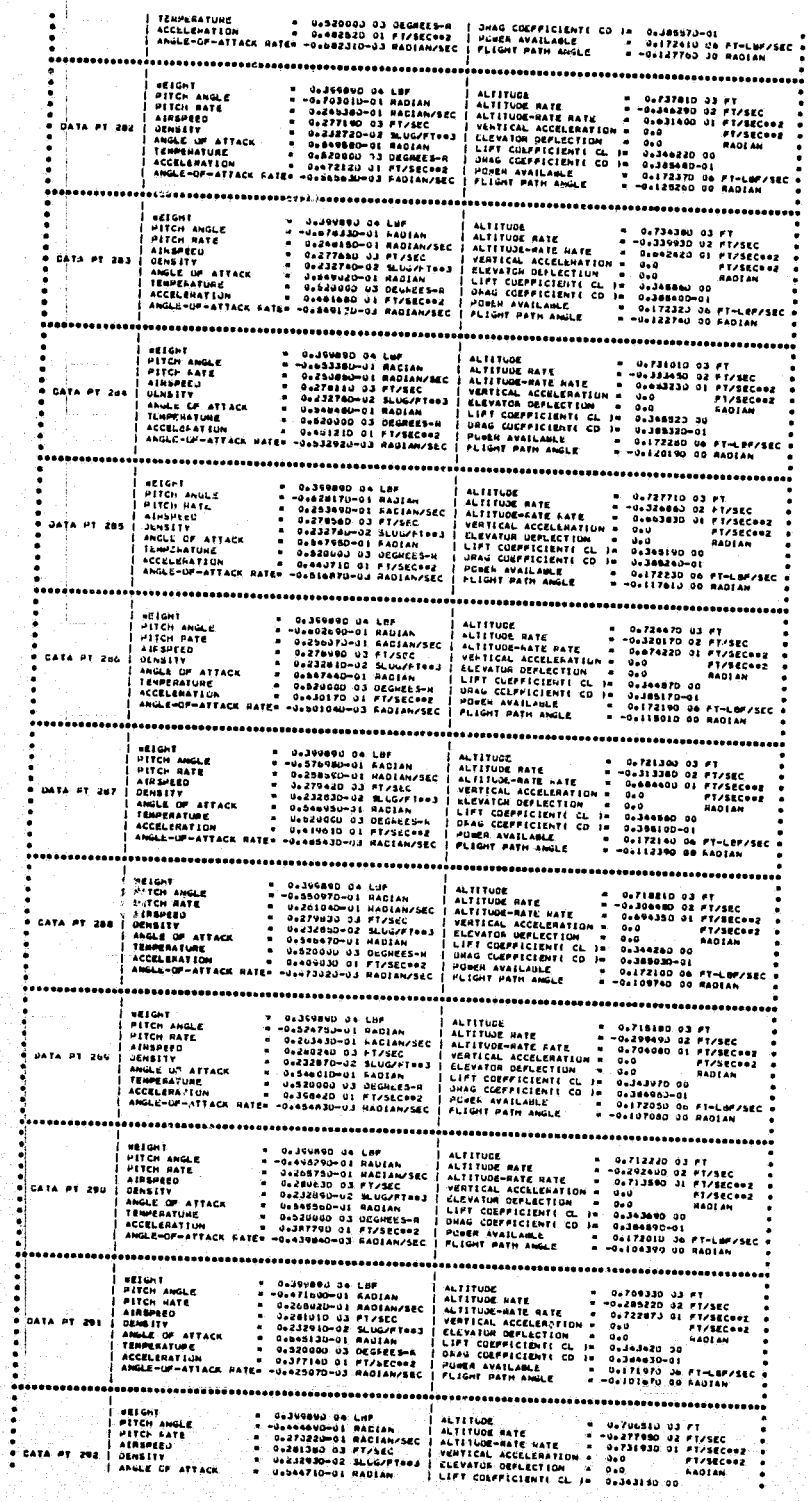
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	ACCELERATION = 0.667320 01 FT/SEC**2	POWER AVAILABLE = 0.173270 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.610830-02 RADIAN/SEC	FLIGHT PATH ANGLE = -0.176760 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.827120 03 FT	
	PITCH ANGLE = -0.116260 00 RADIAN	ALTITUDE RATE = -0.695070 02 FT/SEC	
	PITCH RATE = 0.167970-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.344020 01 FT/SEC**2	
	AIRSPEED = 0.266370 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 260	DENSITY = 0.232510-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.880630-01 RADIAN	LIFT COEFFICIENT(CL)= 0.356830 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.388930-01	
	ACCELERATION = 0.668330 01 FT/SEC**2	POWER AVAILABLE = 0.173260 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.596200-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.173000 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.822580 03 FT	
	PITCH ANGLE = -0.114650 00 RADIAN	ALTITUDE RATE = -0.695150 02 FT/SEC	
	PITCH RATE = 0.172170-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.359180 01 FT/SEC**2	
	AIRSPEED = 0.265040 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 261	DENSITY = 0.232160-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.855430-01 RADIAN	LIFT COEFFICIENT(CL)= 0.356220 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387850-01	
	ACCELERATION = 0.667260 01 FT/SEC**2	POWER AVAILABLE = 0.173210 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.986370-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.171290 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.818090 03 FT	
	PITCH ANGLE = -0.112910 00 RADIAN	ALTITUDE RATE = -0.696780 02 FT/SEC	
	PITCH RATE = 0.176360-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.373620 01 FT/SEC**2	
	AIRSPEED = 0.264730 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 262	DENSITY = 0.232170-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8868JU-01 RADIAN	LIFT COEFFICIENT(CL)= 0.355820 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387710-01	
	ACCELERATION = 0.667070 01 FT/SEC**2	POWER AVAILABLE = 0.173180 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.942800-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.169360 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.813630 03 FT	
	PITCH ANGLE = -0.111130 00 RADIAN	ALTITUDE RATE = -0.696080 02 FT/SEC	
	PITCH RATE = 0.180420-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.387940 01 FT/SEC**2	
	AIRSPEED = 0.264390 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 263	DENSITY = 0.232290-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.883570-01 RADIAN	LIFT COEFFICIENT(CL)= 0.355030 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387560-01	
	ACCELERATION = 0.668020 01 FT/SEC**2	POWER AVAILABLE = 0.173180 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.942910-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.167480 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.809210 03 FT	
	PITCH ANGLE = -0.109330 00 RADIAN	ALTITUDE RATE = -0.440130 02 FT/SEC	
	PITCH RATE = 0.188440-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.402140 01 FT/SEC**2	
	AIRSPEED = 0.263050 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 264	DENSITY = 0.232230-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.882650-01 RADIAN	LIFT COEFFICIENT(CL)= 0.354680 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387430-01	
	ACCELERATION = 0.667140 01 FT/SEC**2	POWER AVAILABLE = 0.173120 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.990490-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.165570 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.804830 03 FT	
	PITCH ANGLE = -0.107440 00 RADIAN	ALTITUDE RATE = -0.443060 02 FT/SEC	
	PITCH RATE = 0.188340-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.416210 01 FT/SEC**2	
	AIRSPEED = 0.262740 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 265	DENSITY = 0.232260-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8817E0-01 RADIAN	LIFT COEFFICIENT(CL)= 0.353890 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387290-01	
	ACCELERATION = 0.667080 01 FT/SEC**2	POWER AVAILABLE = 0.173080 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.d79730-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.163e20 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.800490 03 FT	
	PITCH ANGLE = -0.105940 00 RADIAN	ALTITUDE RATE = -0.431810 02 FT/SEC	
	PITCH RATE = 0.192270-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.430150 01 FT/SEC**2	
	AIRSPEED = 0.260833U 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 266	DENSITY = 0.232290-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8n0890-01 RADIAN	LIFT COEFFICIENT(CL)= 0.353380 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387160-01	
	ACCELERATION = 0.667J57D 01 FT/SEC**2	POWER AVAILABLE = 0.173050 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.d58920-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.161630 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.796190 03 FT	
	PITCH ANGLE = -0.103590 00 RADIAN	ALTITUDE RATE = -0.427440 02 FT/SEC	
	PITCH RATE = 0.196080-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.443950 01 FT/SEC**2	
	AIRSPEED = 0.259490 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 267	DENSITY = 0.232330-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8n0050-01 RADIAN	LIFT COEFFICIENT(CL)= 0.352810 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.387030-01	
	ACCELERATION = 0.667J92D 01 FT/SEC**2	POWER AVAILABLE = 0.173010 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.d39020-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.159600 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.791940 03 FT	
	PITCH ANGLE = -0.101610 00 RADIAN	ALTITUDE RATE = -0.422930 02 FT/SEC	
	PITCH RATE = 0.199830-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.447810 01 FT/SEC**2	
	AIRSPEED = 0.258540 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 268	DENSITY = 0.232350-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.8S0220-01 RADIAN	LIFT COEFFICIENT(CL)= 0.352290 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.386910-01	
	ACCELERATION = 0.667J350 01 FT/SEC**2	POWER AVAILABLE = 0.172970 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.819070-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.157540 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.787730 03 FT	
	PITCH ANGLE = -0.995980-01 RADIAN	ALTITUDE RATE = -0.418280 02 FT/SEC	
	PITCH RATE = 0.203810-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.471110 01 FT/SEC**2	
	AIRSPEED = 0.257190 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 269	DENSITY = 0.232370-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.858810-01 RADIAN	LIFT COEFFICIENT(CL)= 0.351780 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.386790-01	
	ACCELERATION = 0.667J840 01 FT/SEC**2	POWER AVAILABLE = 0.172940 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.796380-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.155440 00 RADIAN	
	WEIGHT = 0.399000 06 LBF	ALTITUDE = 0.783570 03 FT	
	PITCH ANGLE = -0.975680-01 RADIAN	ALTITUDE RATE = -0.413310 02 FT/SEC	
	PITCH RATE = 0.207130-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.484670 01 FT/SEC**2	
	AIRSPEED = 0.255780 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
DATA PT 270	DENSITY = 0.232400-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.857620-01 RADIAN	LIFT COEFFICIENT(CL)= 0.351280 00	

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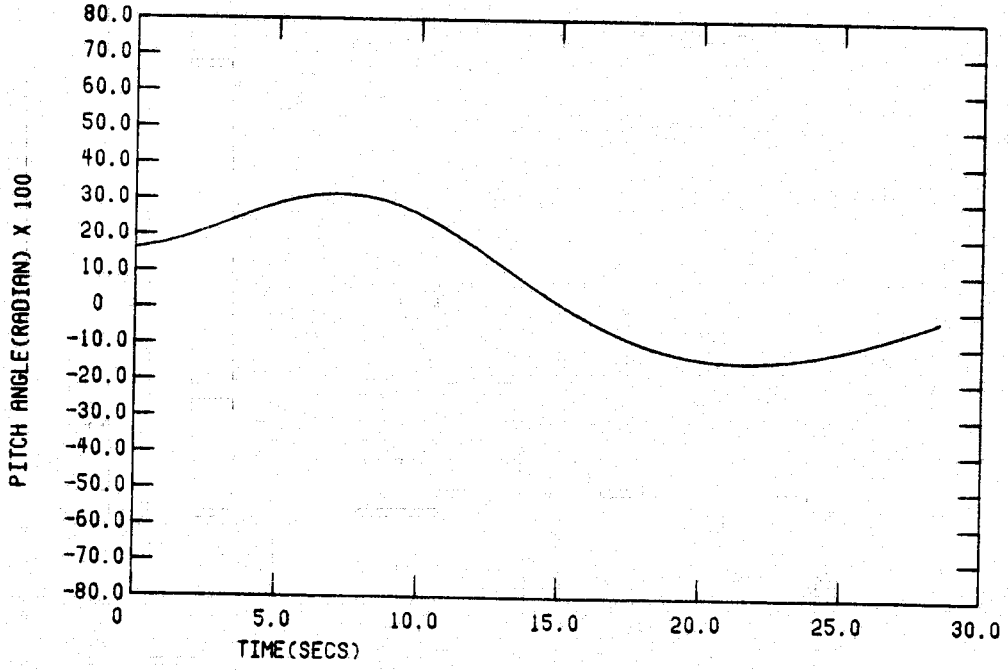


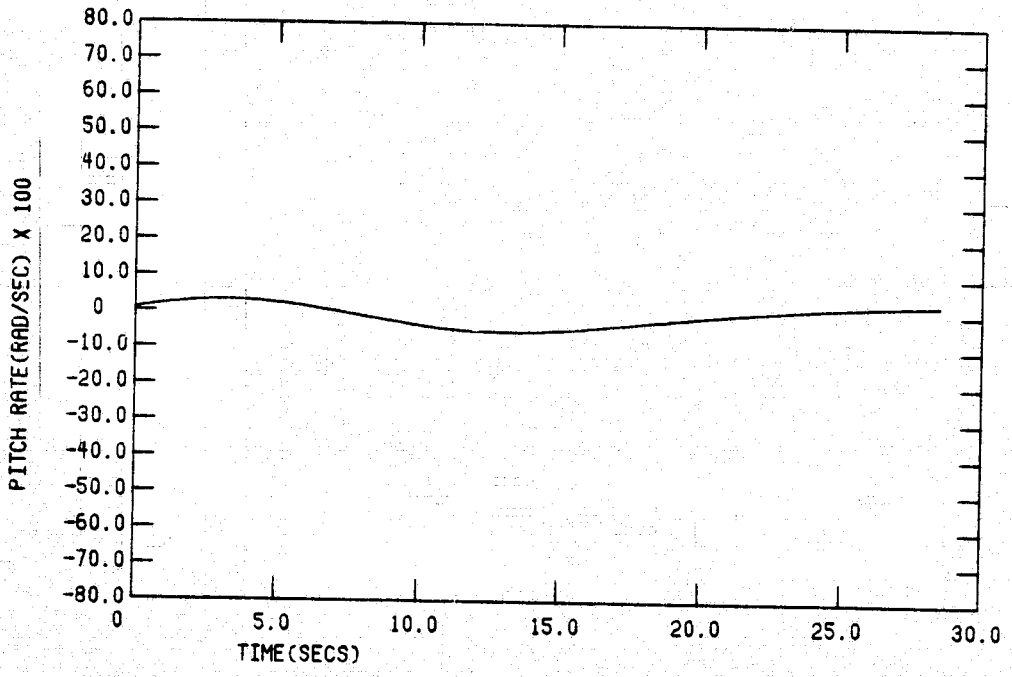


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	ACCELERATION = 0.482820 01 FT/SEC**2	POWER AVAILABLE = 0.172610 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.682310-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.147760 00 RADIAN	
DATA PT 282	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.737810 03 FT	
	PITCH ANGLE = -0.703010-01 RADIAN	ALTITUDE RATE = -0.482890 02 FT/SEC	
	PITCH RATE = 0.269380-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.931400 01 FT/SEC**2	
	AIRSPEED = 0.277190 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.238720-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.849580-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346220 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385680-01	
	ACCELERATION = 0.472120 01 FT/SEC**2	POWER AVAILABLE = 0.172370 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.983630-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.125260 00 RADIAN	
DATA PT 283	WEIGHT = 0.369880 04 LBF	ALTITUDE = 0.734380 03 FT	
	PITCH ANGLE = -0.676430-01 RADIAN	ALTITUDE RATE = -0.339930 02 FT/SEC	
	PITCH RATE = 0.268150-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.842620 01 FT/SEC**2	
	AIRSPEED = 0.277680 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232740-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.849420-01 RADIAN	LIFT COEFFICIENT(CL)= 0.345880 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385400-01	
	ACCELERATION = 0.481680 01 FT/SEC**2	POWER AVAILABLE = 0.172320 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.849170-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.122740 00 RADIAN	
DATA PT 284	WEIGHT = 0.369880 04 LBF	ALTITUDE = 0.731010 03 FT	
	PITCH ANGLE = -0.653380-01 RADIAN	ALTITUDE RATE = -0.333450 02 FT/SEC	
	PITCH RATE = 0.253880-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.803230 01 FT/SEC**2	
	AIRSPEED = 0.278110 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232740-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.848460-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346523 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385320-01	
	ACCELERATION = 0.481210 01 FT/SEC**2	POWER AVAILABLE = 0.172280 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.853290-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.120190 00 RADIAN	
DATA PT 285	WEIGHT = 0.369880 04 LBF	ALTITUDE = 0.727710 03 FT	
	PITCH ANGLE = -0.628170-01 RADIAN	ALTITUDE RATE = -0.326660 02 FT/SEC	
	PITCH RATE = 0.253690-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.883830 01 FT/SEC**2	
	AIRSPEED = 0.279560 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232780-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.847580-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346190 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385260-01	
	ACCELERATION = 0.480370 01 FT/SEC**2	POWER AVAILABLE = 0.172230 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.816870-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.117610 00 RADIAN	
DATA PT 286	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.726670 03 FT	
	PITCH ANGLE = -0.602630-01 RADIAN	ALTITUDE RATE = -0.320170 02 FT/SEC	
	PITCH RATE = 0.250370-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.874220 01 FT/SEC**2	
	AIRSPEED = 0.279980 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232810-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.847440-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346870 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385170-01	
	ACCELERATION = 0.480170 01 FT/SEC**2	POWER AVAILABLE = 0.172190 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.801040-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.115010 00 RADIAN	
DATA PT 287	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.721300 03 FT	
	PITCH ANGLE = -0.576980-01 RADIAN	ALTITUDE RATE = -0.313380 02 FT/SEC	
	PITCH RATE = 0.258450-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.864400 01 FT/SEC**2	
	AIRSPEED = 0.279420 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232830-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.849530-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346580 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385100-01	
	ACCELERATION = 0.479610 01 FT/SEC**2	POWER AVAILABLE = 0.172140 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.485430-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.112390 00 RADIAN	
DATA PT 288	WEIGHT = 0.369880 04 LBF	ALTITUDE = 0.718810 03 FT	
	PITCH ANGLE = -0.550970-01 RADIAN	ALTITUDE RATE = -0.306880 02 FT/SEC	
	PITCH RATE = 0.261040-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.896350 01 FT/SEC**2	
	AIRSPEED = 0.279830 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232850-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.566670-01 RADIAN	LIFT COEFFICIENT(CL)= 0.346260 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.385030-01	
	ACCELERATION = 0.479330 01 FT/SEC**2	POWER AVAILABLE = 0.172100 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.473220-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.109740 00 RADIAN	
DATA PT 289	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.715180 03 FT	
	PITCH ANGLE = -0.524750-01 RADIAN	ALTITUDE RATE = -0.299490 02 FT/SEC	
	PITCH RATE = 0.263430-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.906080 01 FT/SEC**2	
	AIRSPEED = 0.280280 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232870-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.546610-01 RADIAN	LIFT COEFFICIENT(CL)= 0.345970 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.384960-01	
	ACCELERATION = 0.478760 01 FT/SEC**2	POWER AVAILABLE = 0.172050 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.454430-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.107080 00 RADIAN	
DATA PT 290	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.712220 03 FT	
	PITCH ANGLE = -0.496790-01 RADIAN	ALTITUDE RATE = -0.292640 02 FT/SEC	
	PITCH RATE = 0.265730-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.915890 01 FT/SEC**2	
	AIRSPEED = 0.280630 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232890-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.545560-01 RADIAN	LIFT COEFFICIENT(CL)= 0.345690 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.384890-01	
	ACCELERATION = 0.478790 01 FT/SEC**2	POWER AVAILABLE = 0.172010 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.439840-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.104390 00 RADIAN	
DATA PT 291	WEIGHT = 0.369880 04 LBF	ALTITUDE = 0.709330 03 FT	
	PITCH ANGLE = -0.471600-01 RADIAN	ALTITUDE RATE = -0.285220 02 FT/SEC	
	PITCH RATE = 0.268020-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.922670 01 FT/SEC**2	
	AIRSPEED = 0.281010 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232910-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.545130-01 RADIAN	LIFT COEFFICIENT(CL)= 0.345620 00	
	TEMPERATURE = 0.520000 03 DEGREES-R	DRAG COEFFICIENT(CD)= 0.384830-01	
	ACCELERATION = 0.477160 01 FT/SEC**2	POWER AVAILABLE = 0.171970 06 FT-LBF/SEC	
	ANGLE-OF-ATTACK RATE= -0.425070-03 RADIAN/SEC	FLIGHT PATH ANGLE = -0.101670 00 RADIAN	
DATA PT 292	WEIGHT = 0.369890 04 LBF	ALTITUDE = 0.706510 03 FT	
	PITCH ANGLE = -0.446690-01 RADIAN	ALTITUDE RATE = -0.277980 02 FT/SEC	
	PITCH RATE = 0.270230-01 RADIAN/SEC	ALTITUDE-RATE RATE = 0.931930 01 FT/SEC**2	
	AIRSPEED = 0.281380 03 FT/SEC	VERTICAL ACCELERATION = 0.0 FT/SEC**2	
	DENSITY = 0.232930-02 SLUG/FT**3	ELEVATOR DEFLECTION = 0.0 RADIAN	
	ANGLE OF ATTACK = 0.544710-01 RADIAN	LIFT COEFFICIENT(CL)= 0.345350 00	

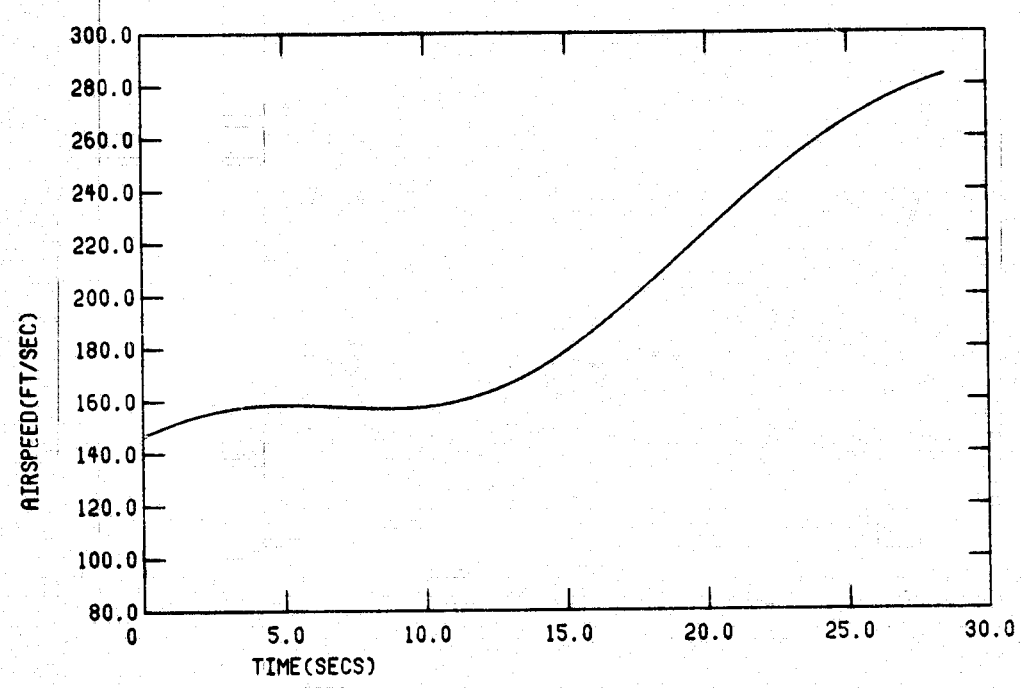
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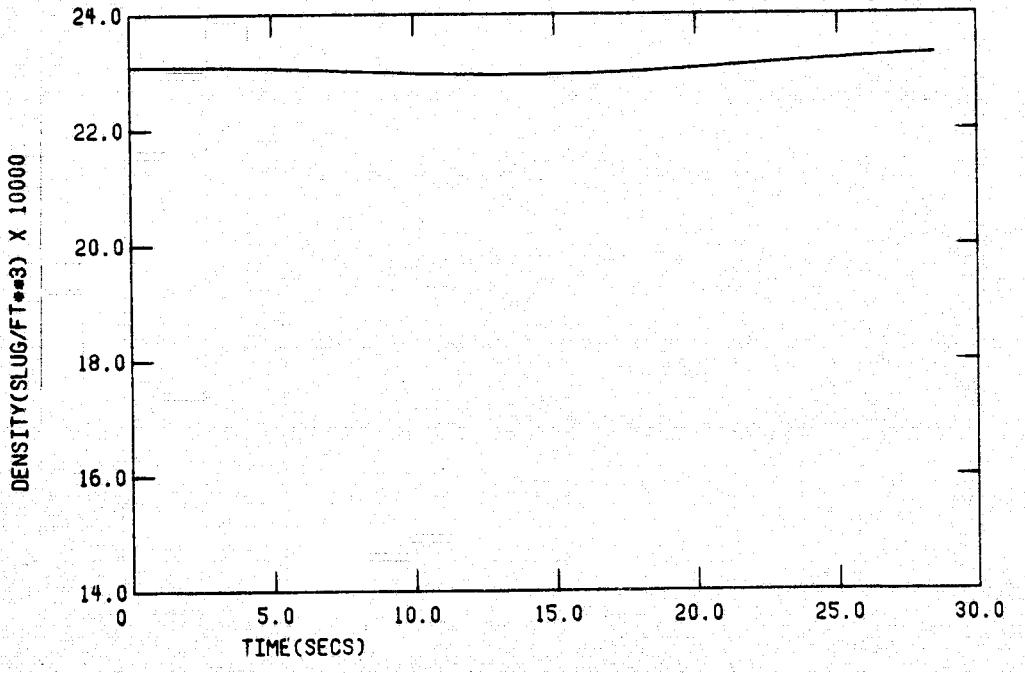
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	ANGLE-OF-ATTACK RATE=	-0.613010-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.968900-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.703770 03	FT
	PITCH ANGLE	= -0.617580-01	RADIAN	ALTITUDE RATE	= -0.270580 02	FT/SEC
	PITCH RATE	= 0.272360-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.740740 01	FT/SEC**2
	AIRSPEED	= 0.281740 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 293	DENSITY	= 0.232950-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.566310-01	RADIAN	LIFT COEFFICIENT(CL)=	0.362900 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384710-01	
	ACCELERATION	= 0.355800 01	FT/SEC**2	POWER AVAILABLE	= 0.171880 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.396180-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.981870-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.701180 03	FT
	PITCH ANGLE	= -0.590280-01	RADIAN	ALTITUDE RATE	= -0.260130 02	FT/SEC
	PITCH RATE	= 0.274430-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.749320 01	FT/SEC**2
	AIRSPEED	= 0.282090 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 294	DENSITY	= 0.232970-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.543920-01	RADIAN	LIFT COEFFICIENT(CL)=	0.362680 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384690-01	
	ACCELERATION	= 0.336110 01	FT/SEC**2	POWER AVAILABLE	= 0.171840 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.382020-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.934140-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.698510 03	FT
	PITCH ANGLE	= -0.562670-01	RADIAN	ALTITUDE RATE	= -0.253600 02	FT/SEC
	PITCH RATE	= 0.276480-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.757670 01	FT/SEC**2
	AIRSPEED	= 0.282630 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 295	DENSITY	= 0.232940-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.543580-01	RADIAN	LIFT COEFFICIENT(CL)=	0.362620 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384630-01	
	ACCELERATION	= 0.334410 01	FT/SEC**2	POWER AVAILABLE	= 0.171830 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.368070-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.908220-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.698690 03	FT
	PITCH ANGLE	= -0.534930-01	RADIAN	ALTITUDE RATE	= -0.267980 02	FT/SEC
	PITCH RATE	= 0.278490-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.768770 01	FT/SEC**2
	AIRSPEED	= 0.282705 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 296	DENSITY	= 0.233080-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.543180-01	RADIAN	LIFT COEFFICIENT(CL)=	0.362190 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384580-01	
	ACCELERATION	= 0.323700 01	FT/SEC**2	POWER AVAILABLE	= 0.171760 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.353610-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.878110-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.698930 03	FT
	PITCH ANGLE	= -0.530740-01	RADIAN	ALTITUDE RATE	= -0.260280 02	FT/SEC
	PITCH RATE	= 0.280260-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.773630 01	FT/SEC**2
	AIRSPEED	= 0.283080 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 297	DENSITY	= 0.233020-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.542460-01	RADIAN	LIFT COEFFICIENT(CL)=	0.361970 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384500-01	
	ACCELERATION	= 0.312490 01	FT/SEC**2	POWER AVAILABLE	= 0.171720 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.343780-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.849830-01	RADIAN
	WEIGHT	= 0.399880 04	LBF	ALTITUDE	= 0.699180 03	FT
	PITCH ANGLE	= -0.527870-01	RADIAN	ALTITUDE RATE	= -0.232510 02	FT/SEC
	PITCH RATE	= 0.282120-01	RADIAN/SEC	ALTITUDE-RATE RATE	= 0.781240 01	FT/SEC**2
	AIRSPEED	= 0.283390 03	FT/SEC	VERTICAL ACCELERATION	= 0.0	FT/SEC**2
DATA PT 298	DENSITY	= 0.233030-02	SLUG/FT**3	ELEVATOR DEFLECTION	= 0.0	RADIAN
	ANGLE OF ATTACK	= 0.542000-01	RADIAN	LIFT COEFFICIENT(CL)=	0.361760 00	
	TEMPERATURE	= 0.520000 03	DEGREES-R	DRAG COEFFICIENT(CD)=	0.384490-01	
	ACCELERATION	= 0.332270 01	FT/SEC**2	POWER AVAILABLE	= 0.171680 06	FT-LBF/SEC
	ANGLE-OF-ATTACK RATE=	-0.327350-03	RADIAN/SEC	FLIGHT PATH ANGLE	= -0.821360-01	RADIAN

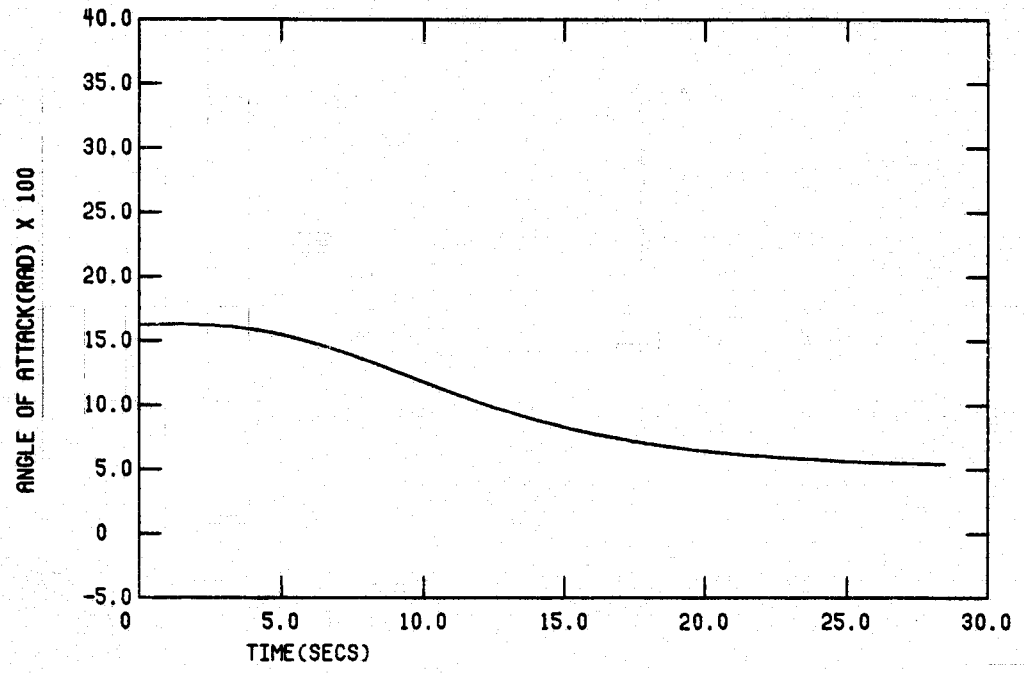

80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
PITCH ANGLE(RADIAN) X 100
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

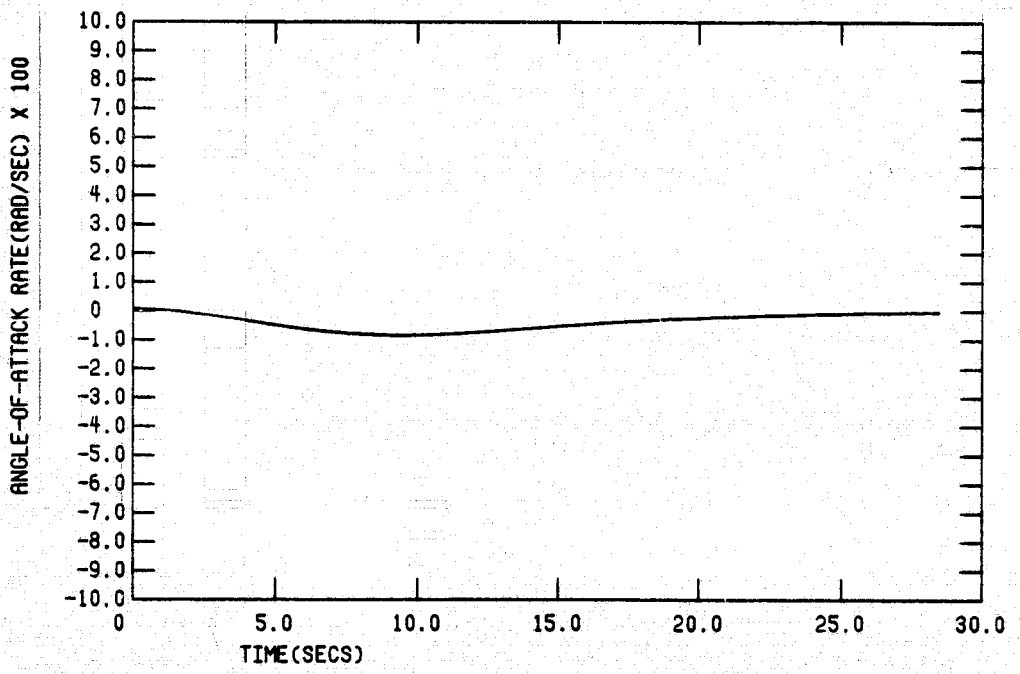

80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
PITCH RATE(RAD/SEC) X 100
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

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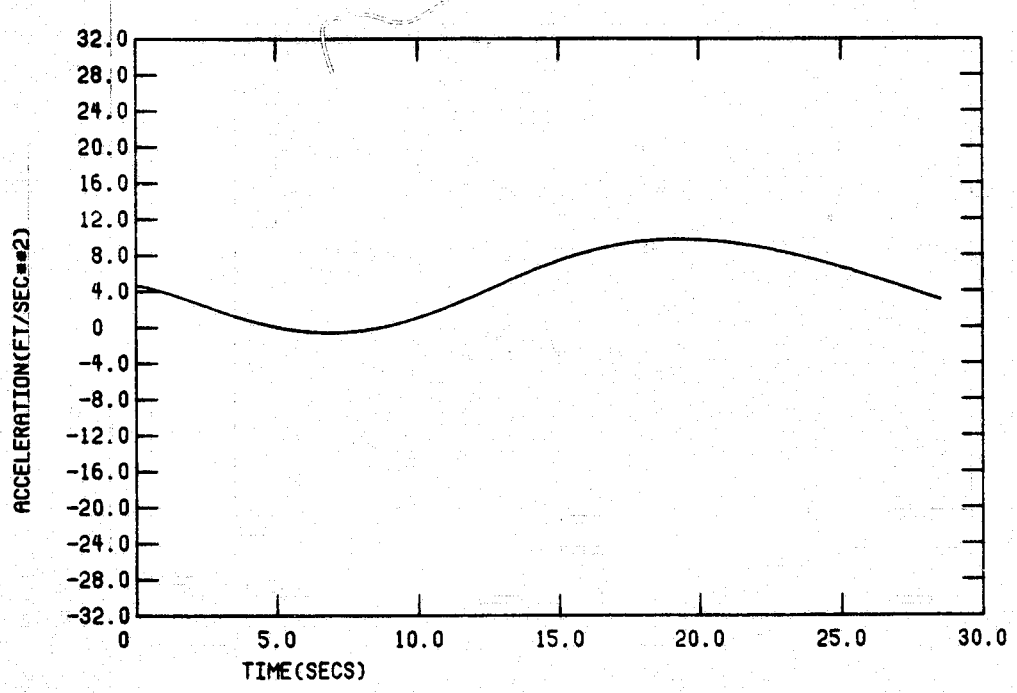


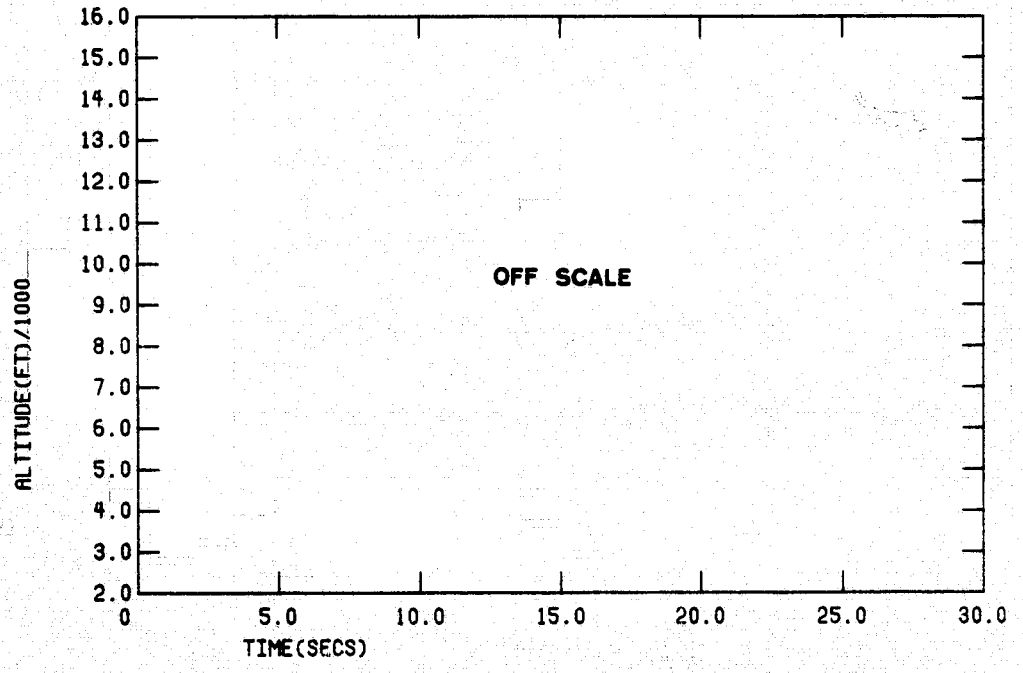


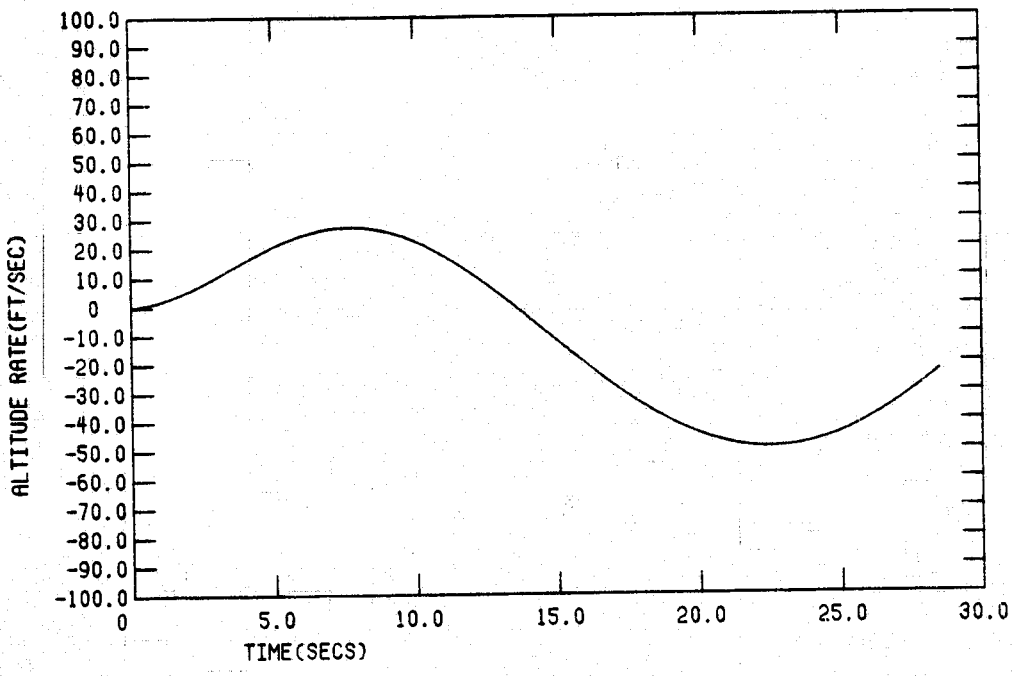

ANGLE OF ATTACK(RAD) X 100
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
-5.0
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

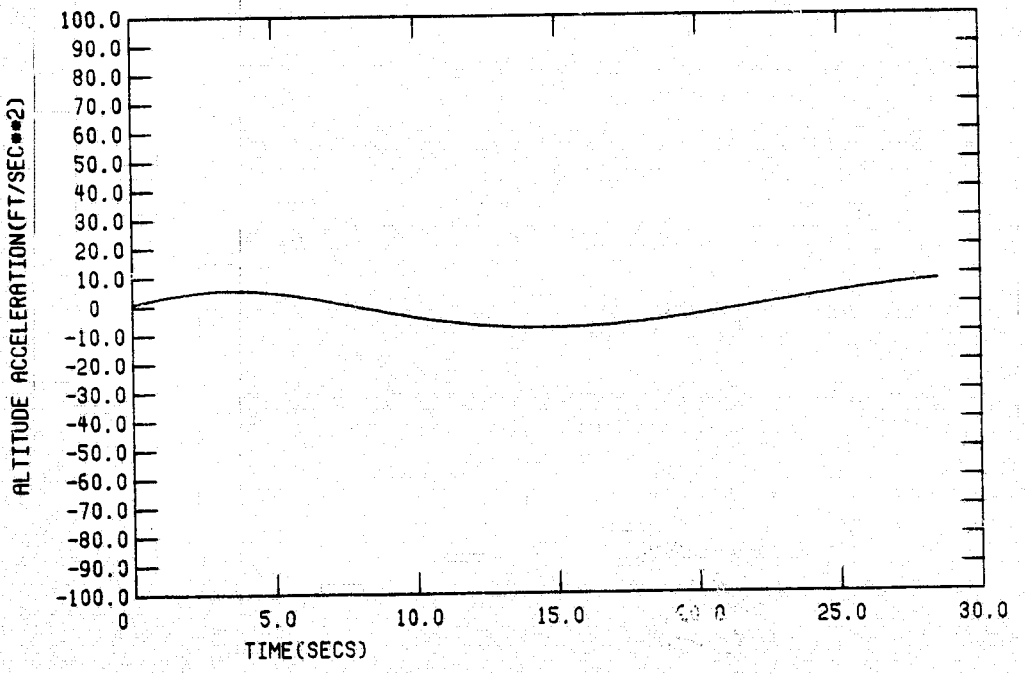

ANGLE-OF-ATTACK RATE(RAD/SEC) X 100
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

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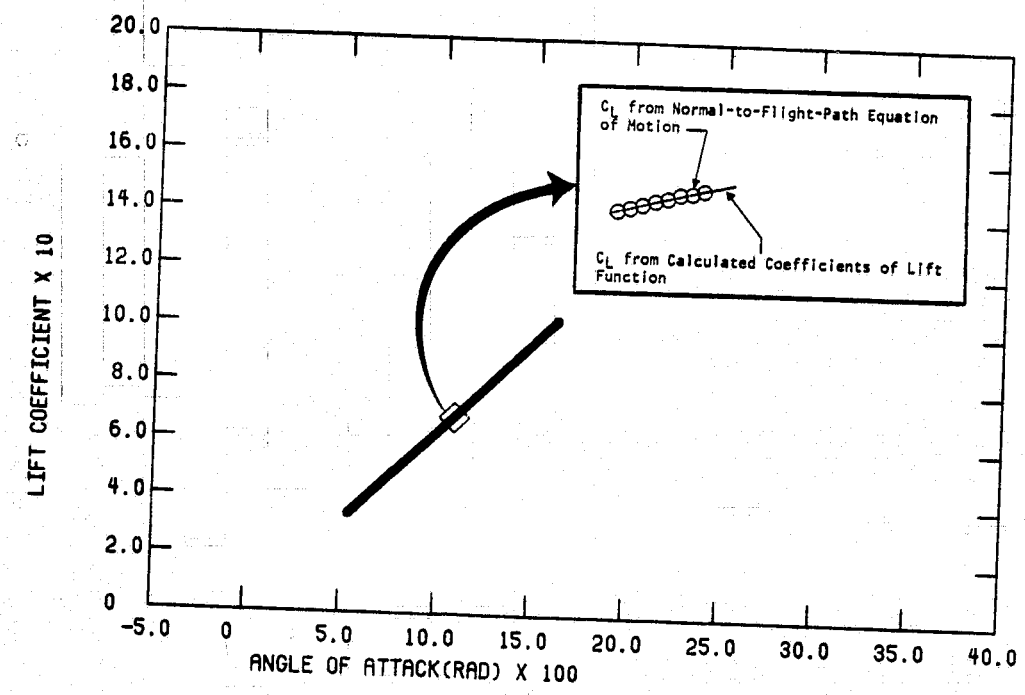


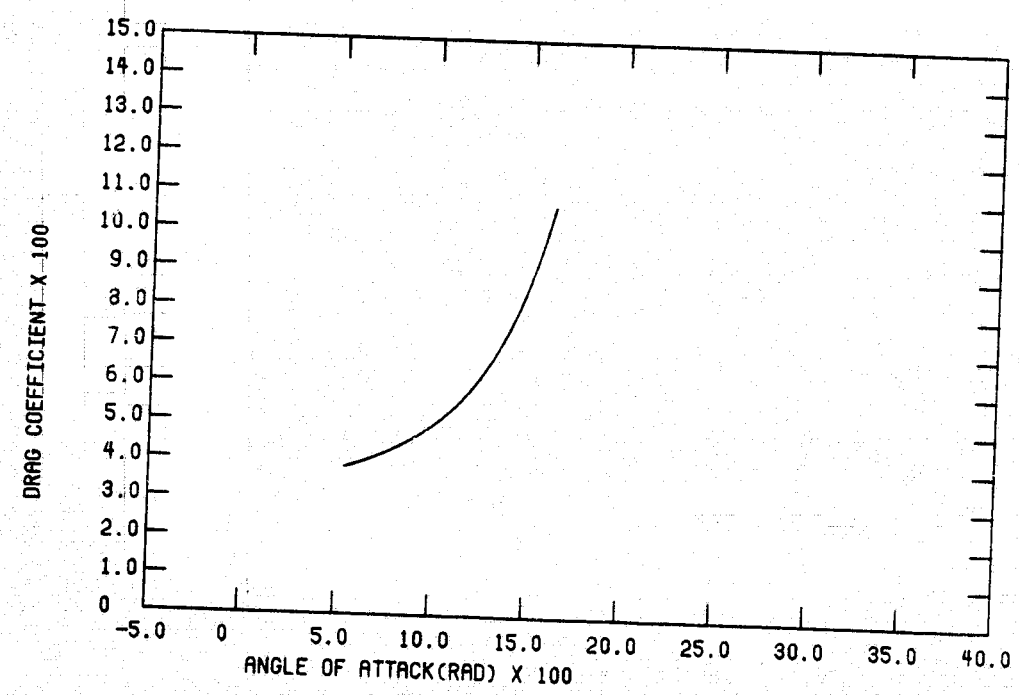


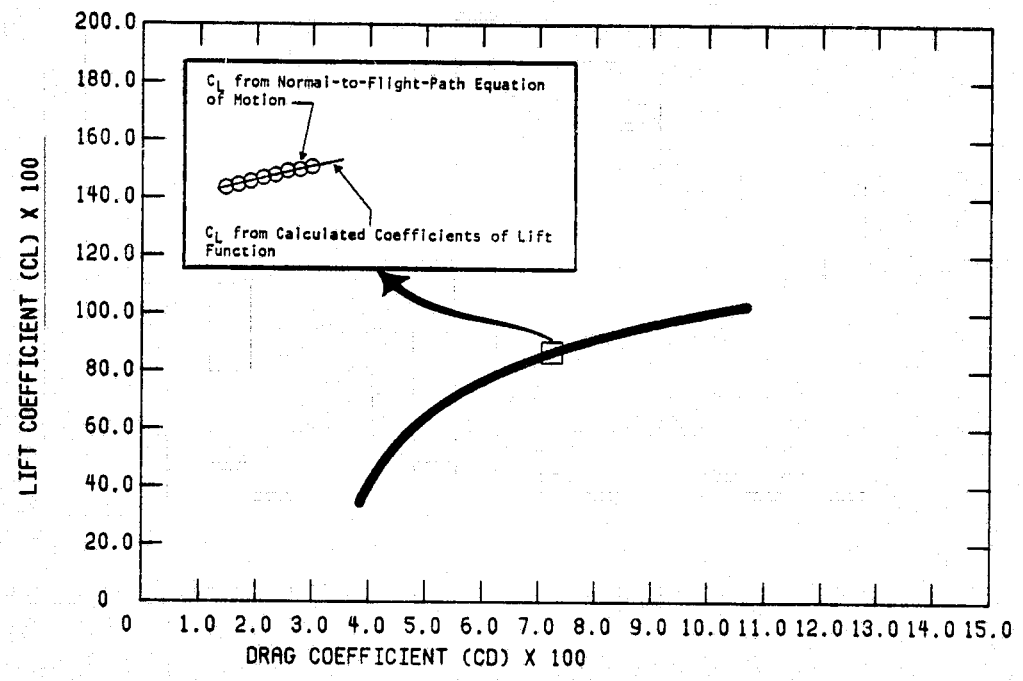

ALTITUDE RATE(FT/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

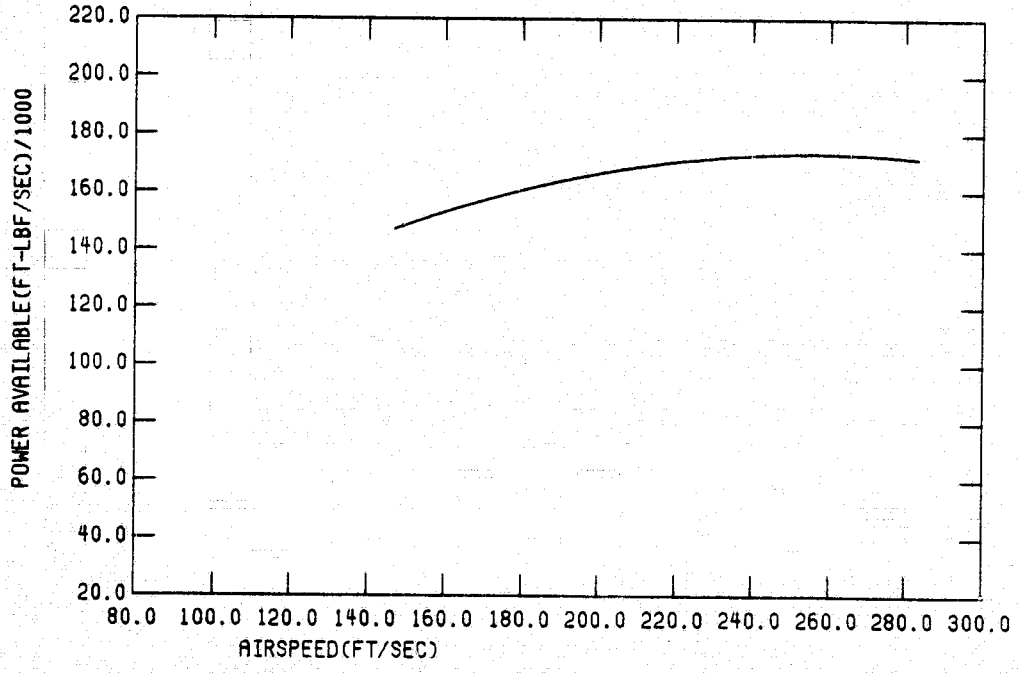

ALTITUDE ACCELERATION(FT/SEC**2)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
0
5.0
10.0
15.0
20.0
25.0
30.0
TIME(SECS)

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LIFT COEFFICIENT (CL) X 100
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0
C_L from Normal-to-Flight-Path Equation of Motion
C_L from Calculated Coefficients of Lift Function
0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0
DRAG COEFFICIENT (CD) X 100


POWER AVAILABLE(FT-LBF/SEC)/1000
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
80.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 260.0 280.0 300.0
AIRSPEED(FT/SEC)

The sample output reproduced here is intended to show generally the type of output which will be obtained from the program, including the final data format and the plotted results. Because only six iterations of the Newton-Raphson procedure were used in the interests of saving computer time and report space, the results are not as accurate as those which can be obtained with additional iterations. As mentioned earlier, with 29 iterations a fit error of 1.33×10^{-13} was obtained in contrast to the present value of 5×10^{-9}. Each additional iteration requires an average of 7 minutes of computer time on the local computer (IBM 370/165). Approximately 4 minutes is required for compilation and linking and 20 minutes for execution of the preliminary procedures, final data computation, and plotting. A full 29 iterations would therefore require about 227 minutes. The results shown here accomplished compile, link, and go in 55 minutes. All times are approximate because actual computational time is dependent on the computer workload at the time the job is processed.

One final note: FDR2 employs the subroutine LLSQAR to solve systems of equations of the type $Ax = b$ by obtaining the pseudo-inverse of A. This is a computing center library routine. It was selected from among the available library routines after some experimentation because it yielded the best results. The superior results are thought to be due to its use of double length words (i.e., 32 decimal digits) for the matrix multiplications and additions, a feature shared by none of the other library routines. Since the A matrices found in FDR2 are always somewhat ill-conditioned, this additional precision is apparently necessary to obtain reasonable results. In fact, additional precision beyond 32 decimal digits would be desirable because tests of the product AA^{-1} or $A^{-1}A$ indicate that the size of the off-diagonal elements may vary from 10^{-7} to 10^{-18} times the size of the diagonal elements. Since the routines which perform the double word arithmetic in LLSQAR are available locally only in assembler versions, they are not reproduced here. The reader desiring to install FDR2 at his own installation should substitute some alternate matrix solver for LLSQAR, taking care to provide at least 32 decimal digit precision.